United States Department of Agriculture

Draft Environmental Impact Statement for the Draft Revised Forest Plan

Custer Gallatin National Forest

Volume 1: Chapters 1 through 4

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Custer Gallatin National Forest Title Page: Photo Credit Top left to right – Aspen budding in spring, CGNF, M. Leuschen-Lonergan; Spring green on the Sioux Ranger District, K. Hansen, CGNF; Arrowleaf Balsomroot blooms in early spring, Sypes Canyon, Bozeman R.D., M. Leuschen-Lonergan; House Rock, high spring runoff, Gallatin Canyon, Bozeman R.D., M. Leuschen-Lonergan; Early spring crocus blooms on forest, M. Leuschen-Lonergan; spring emergence, bear on sypes trail, Bozeman R.D., T. Orr; Bozeman Field School on field trip with Forest Plan Revision specialists, M. Leuschen-Lonergan, Custer Gallatin National Forest, Cattle graze on Ashland R.D., Custer Gallatin National Forest.

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Draft Environmental Impact Statement for the Revised Forest Plan

Custer Gallatin National Forest

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Abstract: This draft environmental impact statement discloses the effects of revising the Custer and Gallatin National Forest Plans, which were developed in the 1980s. The proposed action is to provide revised management direction in one forest plan now that the two national forests are administratively managed as one unit (the Custer Gallatin National Forest). This document contains analysis of five forest plan alternatives developed for the programmatic management of approximately 3,039,000 acres administered by the Custer Gallatin National Forest.

Comments on this draft environmental impact statement must be received or postmarked within 90 days of the Environmental Protection Agency's publication of the notice of availability in the Federal Register. It is important reviewers provide their comments at such times and in such a way that they are useful to the agency's preparation of the final environmental impact statement. Therefore, comments should be provided prior to the close of the comment period and should clearly articulate the reviewer's concerns and contentions. Comments received in response to this solicitation, including names and addresses of those who comment, will be part of the public record. Comments submitted anonymously will be accepted and considered; however, anonymous comments will not provide the respondent with standing to participate in subsequent administrative or judicial reviews.

The decision to approve the revised forest plan for the Custer Gallatin National Forest will be subject to the objection process identified in the Planning Rule at 36 CFR 219 Subpart B (219.50 to 219.62). Only those individuals and entities who have submitted substantive comments related to the Custer Gallatin National Forest plan revision during the opportunities provided for public comment will be eligible to file an objection (36 CFR 219.52(a)).

Electronic comments can be sent to:
https://cara.ecosystem-management.org/Public/CommentInput?project=50185

Comments delivered by U.S. mail can be sent to the Custer Gallatin National Forest Supervisor's Office, 10 East Babcock, Bozeman, MT 59715.

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Chapter 1. Purpose and Need for Action

1.1 Introduction

The National Forest Management Act (NFMA) of 1976 (Public Law 94-588) requires the preparation of an integrated land management plan by an interdisciplinary team for each unit of the National Forest System (NFS). The Forest Service began using new planning regulations (2012 Planning Rule) to guide collaborative and science-based revision of land management plans that promote the ecological integrity of national forests while contributing to social and economic sustainability. Public involvement must be provided in preparing and revising forest plans. Forest plans must provide for multiple use and sustained yield of products and services, and include coordination of outdoor recreation, range, timber, watershed, fish, wildlife and designated areas such as wilderness. The forest plan does not authorize site-specific projects or activities; rather, it establishes overarching direction to guide future project and activity decision making.

The Custer National Forest and the Gallatin National Forest were consolidated in 2014 into the Custer Gallatin National Forest. Prior to the official combination, each forest had its own land management plan (LMP).

The forest plan revision process began with preparation of an assessment that summarized the current status and management of various resources on the Custer Gallatin National Forest. The Final Assessment of Existing Conditions was published in February 2017. This assessment evaluated existing information about relevant ecological, economic, and social conditions, trends, and sustainability, as well as their relationship to the land management plan within the context of the broader landscape. This information was used to identify any need for change in forest resources or in the management of those resources, and as a basis for preparing the Custer Gallatin Draft Revised Forest Plan. The draft revised plan was released as a proposed action for public review and comment (scoping) in early 2018. The comments that were received were used to make changes to the draft plan and to develop alternatives to the proposed action that are analyzed in this this document.

This draft environmental impact statement documents a programmatic National Environmental Policy Act (NEPA) review. It discloses the broad environmental impacts and benefits of the proposed alternatives, in contrast to analyses conducted for site-specific projects. This document describes, in general terms, the expected effects of management during the plan period, but does not predict the site-specific effects of future speculative actions each time the standards and guidelines are implemented at the project level. Those site-specific effects would be disclosed in subsequent NEPA reviews during the implementation of individual projects.

1.2 Proposed Action

The Forest Service proposes to revise the 1986 and 1987 Custer and Gallatin Land Management Plans in compliance with the National Forest System land management planning rule (USDA, 2012a) (36 CFR 219).

The purpose and need for the proposed action is to: create one, unified land management plan (hereinafter referred to as the “draft forest plan” or “draft revised forest plan”) for the Custer Gallatin National Forest, address gaps in current plan direction, changes in ecological, social, and economic conditions, and comply with the 2012 Planning Rule as well other new laws, policy, regulation, and Forest Service direction adopted since 1986.

On January 3, 2018, the Custer Gallatin National Forest released the proposed action with a notice of intent to prepare an environmental impact statement (EIS) in the Federal Register. The notice of intent initiated the scoping process, which guides the development of the environmental impact statement. The Custer Gallatin National Forest received over 10,000 public comments on the proposed action during the 60-day comment period, which ended March 5, 2018. The Custer Gallatin plan revision team reviewed all comments received, and the responsible official identified the significant issues that were used to frame alternatives for the draft forest plan. The planning team used these issues and public comments to refine the proposed action and build alternatives.

Additional documentation, including more detailed analysis of project area resources, public involvement information and background information for the resource analyses may be found at the Custer Gallatin National Forest Supervisor’s Office.

1.3 Document Organization

The Custer Gallatin Draft Environmental Impact Statement is organized into two documents:

- **Volume 1**
    - Chapter 1: Purpose and Need, Proposed Action, and Decision Framework
    - Chapter 2: Public Involvement, Issues and Alternatives
    - Chapter 3: Affected Environment and Environmental Consequences
    - Chapter 4: Other disclosures, Preparers, and Distribution of the Environmental Impact Statement
    - Literature Cited
- **Volume 2**
    - Appendices

1.4 The Planning Area

The Custer Gallatin National Forest (the planning area), encompasses over 3 million acres in southern Montana and the northwest corner of South Dakota. Stretching over 400 miles from its westernmost to its easternmost boundaries, the Custer Gallatin is a highly diverse national forest ecologically, socially, economically, and culturally.

The Custer Gallatin National Forest consists of two individual proclaimed national forests: the Custer National Forest and the Gallatin National Forest. In 2014, the two national forests were combined to be administratively managed as one national forest. For ease of discussion throughout this document, the Custer Gallatin National Forest will also be referred to as the Custer Gallatin or the national forest when referencing the single administrative unit, the staff that administers the unit, or the national forest lands within the unit. The consolidated Custer Gallatin continues to operate with the forest plans developed for each national forest in the 1980s, as amended.

The national forest includes portions of eleven counties (ten counties in Montana and one county in South Dakota). The Custer Gallatin is administered in seven ranger districts, with offices located in Camp

Crook, South Dakota, and in Ashland, Red Lodge, Livingston, Gardiner, Bozeman, and West Yellowstone, Montana. The supervisor's office is located in Bozeman, and an office is located in Billings, Montana.

The Custer Gallatin National Forest includes lands on the northern end of the Greater Yellowstone Area, and several island mountain ranges. Individual places across the Custer Gallatin National Forest have their own unique characteristics and conditions; these places, referred to as "geographic areas" (GAs), define a landscape people associate with on the national forest. The Custer Gallatin determined geographic areas using distinct land masses of the national forest, coupled with a sense of place with meaning to the public. While Ashland and the Pryor Mountains are separate geographic areas, the eight individual land units of the Sioux District are grouped into one geographic area. Because the Bridger, Bangtail, and Crazy Mountains are in close proximity, they are grouped into one geographic area. The Greater Yellowstone Area lands south of Interstate 90 were divided into two geographic areas at the Yellowstone River, because one geographic area would be such a large area it begins to lose a distinctive sense of place. Figure 1 displays the six geographic areas, and table 1 displays the acres of the national forest by geographic area.

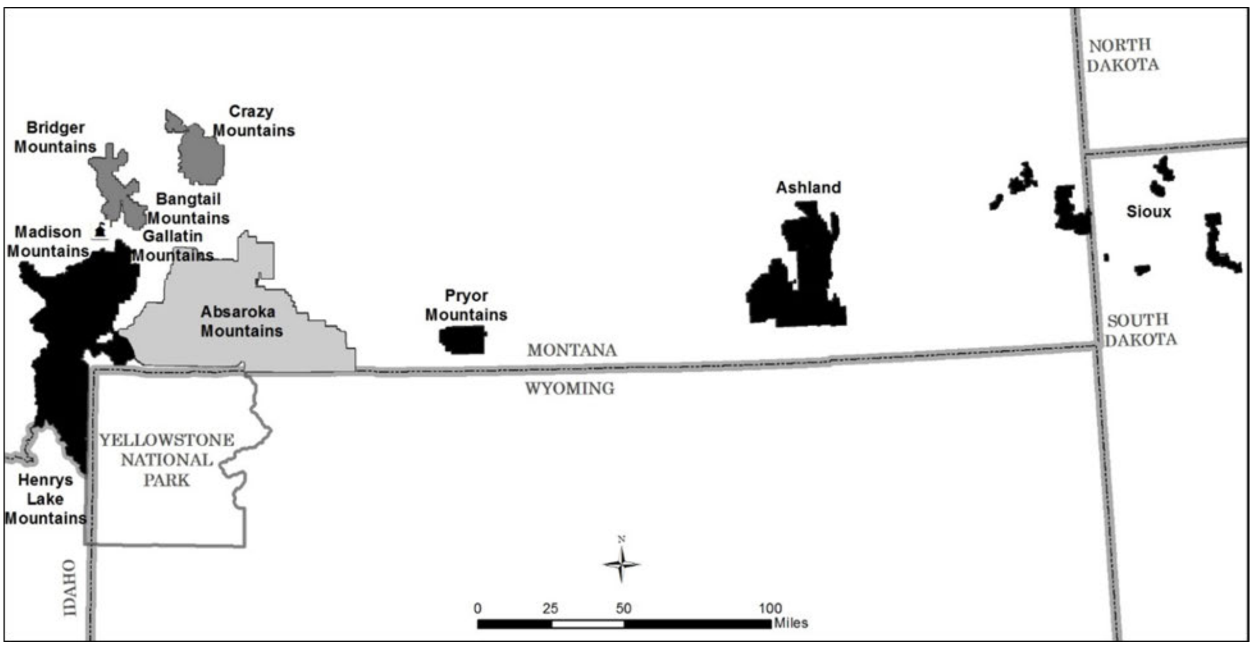

Figure 1. Location of the Custer Gallatin National Forest and geographic areas

Table 1. Acres within the six geographic areas (GAs) on the Custer Gallatin National Forest

Geographic Area	Total Acres (All Ownerships)	National Forest System Acres within GA	Percent of GA in National Forest System Lands
Sioux	177,636	164,460	92
Ashland	501,798	436,124	87
Pryor Mountains	77,944	75,067	96
Absaroka Beartooth Mountains	1,387,824	1,353,295	93
Bridger, Bangtail, and Crazy Mountains	314,598	205,025	64
Madison, Henrys Lake, and Gallatin Mountains	952,813	805,299	85

1.5 Purpose and Need for Action

The purpose of the revised Custer Gallatin Land Management Plan is to revise the 1986 Custer and 1987 Gallatin Forest Plans and to provide an integrated set of plan direction for social, economic, and ecological sustainability, and multiple uses of the Custer Gallatin lands and resources.

Changes in the current plans are needed to address requirements of the 2012 Planning Rule, findings from the assessment, changes in conditions and demands since the 1986 and 1987 forest plans, and public concerns. The draft revised forest plan is an outcome of collaboration with State and local governments, other Federal agencies, tribal consultation, and public involvement.

In the 30 years since the current forest plans were developed: (1) the two national forests have been combined administratively to be managed as a single national forest, (2) demographics have shifted, (3) new threats have emerged, (4) new Forest Service planning regulations have been adopted, and (5) new laws and policies have been adopted. Four broad categories described below relate to the need to change. Taken together, the changes related to these four categories will result in substantial changes to the current plans. The Preliminary Need to Change the Existing Custer and Gallatin Forest Plans (February 2017) describes each category, with examples, in more detail:

- Address gaps in current plan direction, shifting demographics, and new threats that have emerged.
    - ♦ Population growth near the national forest has increased demands for additional recreation opportunity and access to the national forest.
    - ♦ Plan direction reflecting the Custer Gallatin National Forest's role in supporting local economies through both commodity production, including timber, permitted grazing, and other multiple-uses, and the service-based economy that includes recreation and tourism.
    - ♦ Plan direction reflecting the Custer Gallatin National Forest's role in meeting the range of public recreation demands considering the social, environmental, fiscal, and regional context.
    - ♦ Plan direction to prevent aquatic invasive species; neither current plan has direction relate to this threat.
    - ♦ Plan direction to prevent disease (for example, white-nose syndrome in bats and white pine blister rust); current plans have no direction related to disease.
    - ♦ The Forest Service acquired roughly 73,000 acres since the current plans were adopted, and there is a need to provide management direction for these lands.
- Create one, unified forest plan for the Custer Gallatin National Forest.
    - ♦ Depending on the resource or land use, either the Gallatin or the Custer Forest Plan may have flexible or prescriptive management direction. Each plan has unique delineations and descriptions of management areas. The number, arrangement, boundaries, and plan direction for the existing management areas in the current plans are challenging to apply to project-level activities. A unified plan replacing tactical, prescriptive language with strategic language is needed to provide more efficient project planning.
    - ♦ Unified plan direction is needed for topics such as wildland fire management, watershed management, scenery management, and the recreation opportunity spectrum.

- Comply with the 2012 Planning Rule and associated directives;
  - ♦ Direction is needed to address social, economic and ecological sustainability and multiple uses.
- Reflect new laws, policy, regulation, and Forest Service direction adopted since 1986.

Revision is also needed because the current plans are beyond the 10 to 15 year duration provided by the National Forest Management Act (NFMA) (16 U.S.C. 1606(e) (5) (A)).

1.6 Decision Framework

The 2012 Planning Rule specifies eight primary decisions to be made in forest plans:

- Forestwide components to provide for integrated social, economic, and ecological sustainability, and ecosystem integrity and diversity, while providing for ecosystem services and multiple uses. Components must be within Forest Service authority and consistent with the inherent capability of the national forest (36 Code of Federal Regulations (CFR) 219.7 and 219.8–219.10).
- Identification of geographic area and management area specific components (36 CFR 219.7(d).
- Identification of suitability of areas for the appropriate integration of resource management and uses, including lands suited and not suited for timber production (36 CFR 219.7(c)(2)(vii) and 219.11).
- Identification of the maximum quantity of timber that may be removed from the national forest (36 CFR 219.7(c)(2)(ix) and 219.11 (d)(6)).
- Identification of watersheds that are a priority for maintenance or restoration (36 CFR 219.7(f)(i).
- Recommendations to Congress (if any) for lands suitable for inclusion in the National Wilderness Preservation System and rivers eligible for inclusion in the National Wild and Scenic Rivers System (36 CFR 219.7(c)(2)(v) and (vi)).
- Identification or recommendation (if any) of other designated areas (36 CFR 219.7(c)(2)(vii).
- Plan monitoring program (36 CFR 219.7 (c)(2)(x) and 219.12.

The responsible official for the revised forest plan is the forest supervisor. After reviewing the results of the analysis evaluated in the final environmental impact statement (FEIS), the responsible official will issue a draft record of decision (ROD), in accordance with agency decision making procedures (40 CFR 1505.2) that will:

- disclose the decision (identifying the selected alternative) and reasons for the decision;
- discuss how public comments and issues were considered in the decision;
- and discuss how all alternatives were considered in reaching the decision, specifying which one is the environmentally preferable alternative (defined in 36 CFR 220.3).

The draft forest plan includes recommendations for areas that can only be designated by statute, such as wilderness. The draft forest plan provides a draft set of integrated plan direction for managing the national forest for the next 10 to 15 years. However, even after approval of the plan, project level environmental analysis will still need to be completed for specific proposals to implement the direction in the forest plan. Forest plans do not make budget decisions. Should Congress emphasize specific programs by appropriation, a redistribution of priorities would follow, regardless of the alternative implemented.

1.7 Relationship to Other Entities

The 2012 Planning Rule (36 CFR 219.4(b)) requires the review of the planning and land use policies of other Federal agencies, State and local governments, and Indian Tribes. The Custer Gallatin staff consults with 18 American Indian Tribes to gauge interest and issues for the forest plan revision. The national forest established an "Intergovernmental Working Group" for city, county, State, Federal, and Tribal representatives with webinars several times a year focused on current planning topics. District rangers periodically brief county commissioners at county commission meetings. Forest planners brief the Custer Gallatin Working Group at its monthly meetings and have met as requested with individuals and interest groups.

The national forest notified all members of the Intergovernmental Working Group of the opportunity to participate as a cooperating agency in forest plan revision, and the topic was the subject of an Intergovernmental Working Group webinar in January 2018. Four agencies requested cooperating agency status, and formal agreements have been executed for these four agencies:

- Park County, Montana
- Sweet Grass County, Montana
- South Dakota Department of Game Fish and Parks
- The State of South Dakota, represented by the South Dakota Department of Agriculture

The Forest Service reviewed the relevant planning and land use policies of other public agencies to understand and give consideration to those agencies' objectives. The Forest Service is not required to ensure that a Forest Service land management plan is in accord with State, local or Tribal resource and land management plans. In the course of considering those agencies' objectives, however, the Forest Service considers ways the Forest Service land management plan could contribute to common objectives, address impacts, resolve or reduce conflicts and contribute to compatibility between Forest Service and other agencies' plans.

Appendix E of this environmental impact statement displays the compatibility review of 11 County Growth Policies and County Comprehensive Plans, the City of West Yellowstone Growth Policy, State Forest Action Plans, State Wildlife Action Plans, Statewide Comprehensive Outdoor Recreation Plans, Bureau of Land Management Resource Management Plans, the Yellowstone National Park Foundation Document and Land Management Plans of adjacent forests. Cooperating agencies contributed the review of plans within their jurisdictions. Individual sections of the draft environmental impact statement may evaluate additional plans.

1.8 Forest Service Planning

Forest Service planning takes place at different organizational levels and geographic scales. Planning occurs at three levels—national strategic planning, National Forest System unit planning, and project or activity planning. The Chief of the Forest Service is responsible for national planning, such as preparation of the Forest Service strategic plan that established goals, objectives, performance measures, and strategies for management of the national forests. National forest unit planning results in the development, amendment, or revision of a land management plan, such as the Custer Gallatin Forest Plan. The supervisor of the national forest is the responsible official for the development and approval of a plan, plan amendment, or plan revision for lands under the responsibility of the supervisor. The forest supervisor or district ranger is the responsible official for project and activity planning (219.2).

1.8.1 National Strategic Planning

The USDA Forest Service Strategic Plan: Fiscal Year 2015-2020 contains four outcome-oriented goals for the Forest Service, each with strategic objectives. The strategic plan can be accessed online (www.fs.fed.us/strategicplan). The first two goals and related objectives are directly related to the current planning effort:

- Sustain our Nation's forests and grasslands
  - Foster resilient, adaptive ecosystems to mitigate climate change
  - Mitigate wildfire risk
  - Conserve open space
- Deliver benefits to the public
  - Provide abundant clean water
  - Strengthen communities
  - Connect people to the outdoors

The Forest Service continues to use the results of the 2010 Resources Planning Act Assessment (USDA, 2012c and 2016), a report on the status and projected future trends of the nation's renewable resources on all forests and rangelands, as required by the 1974 Forest and Rangeland Renewable Resources Planning Act. The assessment includes analyses of forests, rangelands, wildlife and fish, biodiversity, water, outdoor recreation, wilderness, urban forests, and the effects of climate change on these resources. The assessment provides a snapshot of current U.S. forest and rangeland conditions (all ownerships), identifies drivers of change for natural resource conditions, and projects the effects of those drivers on resource conditions 50 years into the future. This assessment uses a set of future scenarios that influence the resource projections, allowing the exploration of a range of possible futures for United States renewable natural resources. Alternative future scenarios were used to analyze the effects of human and environmental influences on U.S. forests and rangelands, including population growth, domestic and global economic growth, land use change, and climate change.

In addition, the U.S Department of Agriculture (USDA) strategic plan for fiscal years 2018-2022 has specific goals that also align with the 2012 Planning Rule, including (1) facilitate rural prosperity and economic development, and (2) ensure productive and sustainable use of Our National Forest System lands. The USDA strategic plan can be accessed on the USDA's Web site (www.usda.gov).

1.8.2 National Forest System Unit Planning

The National Forest Management Act of 1976 (Pub. L. 94-588) amended the Forest and Rangeland Renewable Resources Planning Act of 1974. The National Forest Management Act requires the preparation of an integrated land management plan by an interdisciplinary team for each unit of the National Forest System (national forests and grasslands). The public must be involved in preparing and revising land management plans, also called forest plans. Forest plans must provide for multiple use and sustained yield of products and services and include coordination of outdoor recreation, range, timber, watershed, fish, wildlife, and designated areas such as wilderness. The forest plan does not authorize site-specific prohibitions or activities; rather, it establishes overarching direction to guide future project and activity decision making.

The 2012 Planning Rule for Land Management Planning for the National Forest System sets forth process and content requirements to guide the development, amendment, and revision of land management plans to maintain and restore National Forest System land and water ecosystems while providing for ecosystem services (the benefits people obtain from the National Forest System planning area) and multiple uses (USDA, 2012b). The final planning directives, effective January 30, 2015, are the key set of agency guidance documents that direct implementation of the 2012 Planning Rule (USDA, 2015).

1.8.3 Project and Activity Planning Consistency and Transition to the Revised Plan

As required by National Forest Management Act and the planning rule, subject to valid existing or statutory rights, all projects and activities authorized by the Forest Service after approval of this plan must be consistent with the applicable plan components (16 U.S.C. 1604(i)) as described at 36 CFR 219.15. Previously approved and ongoing projects and activities are not required to meet the direction of the forest plan and will remain consistent with the direction in the 1986 and 1987 forest plans, as amended.

All project or activity approval documents, made after the effective date of the plan, will describe how the project or activity is consistent with the applicable components of the forest plan. When a proposed project or activity would not be consistent with the applicable plan components, the responsible official shall take one of the following steps, subject to valid existing rights:

1. Modify the proposed project or activity to make it consistent with the applicable plan components;
2. Reject the proposal or terminate the project or activity;
3. Amend the plan so that the project or activity will be consistent with the plan as amended;
4. Amend the plan contemporaneously with the approval of the project or activity so that the project or activity will be consistent with the plan as amended. This amendment may be limited to apply only to the project or activity.

Resource plans (example travel management plans) developed by the national forest that apply to the resources or land areas within the planning area must be consistent with the plan components. Resource plans developed prior to this plan decision will be evaluated for consistency with the plan and updated if necessary.

Authorizations for occupancy and use made before this plan approval may proceed unchanged until time of reauthorization. At time of reauthorization, all permits, contracts, and other authorizing instruments must be made consistent with the forest plan, subject to subject to valid existing or statutory rights, as provided at 36 CFR 219.15(d).

Chapter 2. Alternatives

2.1 Introduction

This chapter describes and compares the alternatives considered by the responsible official for the draft forest plan. It includes a discussion of how the alternatives were developed, issues raised, descriptions and comparisons of the alternatives, and alternatives that were not considered in detail. Numbers such as acres, miles, and volumes are approximate due to the use of geographic information systems data and rounding.

Chapter 2 presents the alternatives in comparative form, providing a clear basis for choice among options by the decision maker. Chapter 3, "Affected Environment and Environmental Consequences," summarizes the information used to compare alternatives and contains the detailed basis used to measure the potential environmental consequences of each of the alternatives.

2.2 Alternative Development

As discussed in Chapter 1, this forest plan revision effort is based on the requirements of the 2012 Planning Rule, findings of the forest assessment, changes in conditions and demands since the 1986 and 1987 forest plans, and public concerns. A list of significant issues was identified from the public involvement period, and some of these issues drove the development of alternatives. Some additional items, such as the Wild and Scenic River eligibility study and the wilderness inventory and evaluation, are addressed in the revision because they are required by planning regulations (such as, 36 CFR 219.17(3)(b)(1)).

The Council on Environmental Quality regulations, with respect to the National Environmental Policy Act (NEPA) procedures and specifically the aspect related to alternative development (36 CFR 40 1502.14), are fundamental to the process. This section of the Code of Federal Regulations reads as follows:

> This section is the heart of the EIS. Based on the information and analysis presented in the sections on the affected environment (1502.15) and the environmental consequences (1502.16), it should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public. In this section agencies shall:
>
> a. Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated.
> b. Devote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits.
> c. Include reasonable alternatives not within the jurisdiction of the lead agency.
> d. Include the alternative of no action (which represents the current plans).
> e. Identify the agency's preferred alternative or alternatives, if one or more exists, in the draft statement and identify such alternative in the final statement unless another law prohibits the expression of such a preference.
> f. Include appropriate mitigation measures not already included in the proposed action or alternatives.

All reasonable alternatives to the proposed action must meet the purpose and need for change and address one or more of the significant issues. Not all possible alternatives were carried into detailed study, because the list of options would have been prohibitively large. Instead, the responsible official identified those alternatives that met the criteria and created a reasonable range of outputs, direction, costs, management requirements, and effects from which to choose.

Revised plan alternatives represent a range of possible management options. Information presented here and in Chapter 3 provide the basis from which to evaluate the comparative merits of the alternatives. Each alternative emphasizes specific land and resource uses and deemphasizes other uses in response to the significant issues.

Alternative A (often referred to as the current plans in this document) is the no-action alternative, which reflects the 1986 and 1987 forest plans, as amended to date, and accounts for current laws, regulations, and terms and conditions from biological opinions. Alternative B was released for public review and comment as the proposed action, and subsequently updated in response to public comment and internal Forest Service review. Development of the alternatives C, D, and E was driven by issues identified during scoping.

The Custer Gallatin has not identified a preferred alternative(s) at this point, but plans to identify a preferred alternative in the final environmental impact statement (FEIS) after reviewing and considering the analysis presented in this document and comments received by the public.

2.3 Public Involvement

The Custer Gallatin forest plan revision process was publicly launched in January 2016 with email announcements, a press release, social media, and web site information. A Federal Register notice of initiation for the Assessment of the Custer Gallatin National Forest was published on February 4th, 2016. The forest plan revision team held 15 public meetings in February and March 2016 to explain forest plan revision; to describe the scope and scale of the national forest; and to gather local knowledge and information, current trends, conditions, perceptions and concerns.

A second set of meetings during the summer of 2016 shared information about results to date on the assessment process and early ideas of the need to change the existing forest plans. These meetings also provided a forum for people to share what they care about and what they want to see from the Custer Gallatin National Forest. A Draft Assessment Report and twenty five draft, in depth topical reports were released for public review on November 30, 2016 and feedback was requested by January 6, 2017. The national forest received about 150 submissions from the public, plus approximately 600 letters asking that bison be identified as a species of conservation concern and a focal species. The plan revision team examined all feedback, and updated the Assessment Report and individual specialist reports as appropriate.

As planning moved into development of a proposed action, a third set of public meetings were held in early 2017 and focused on the distinctive roles and contributions of the Custer Gallatin and on developing desired conditions. In summer 2017, public feedback was requested on the draft eligible Wild and Scenic Rivers and the Wilderness Inventory. Webinars provided an overview of both of these processes. A fourth set of meetings during the fall of 2017 gathered the public’s ideas on early plan components.

The notice of intent for the proposed action to prepare an environmental impact statement was published in the Federal Register on January 3, 2018. The notice of intent asked for public comment on the proposal for a 60-day period. The agency held 16 public meetings and 8 webinars to provide opportunities to better understand the proposed action so that meaningful public comments could be provided by the end of the scoping period. The national forest received about 10,500 comments, of which about 1,000 were considered unique comments. Using the comments from the public, other agencies, tribes, and organizations, the Custer Gallatin's interdisciplinary team developed a list of issues to address through changes to the proposed action, development of alternatives, or in analysis of impacts of the alternatives.

In April 2018, the national forest shared a range of preliminary alternatives focused on recommended wilderness and other forest plan allocations. Forest plan land allocations were of interest to many who commented on the proposed action. The maps were available online and the national forest hosted two public meetings for the public to review and provide feedback on the range of preliminary alternatives. The preliminary alternatives were revised in response to public feedback and further internal review.

2.4 Issues

Issues serve to highlight effects or unintended consequences that may occur from the proposed action or alternatives, giving opportunities during the analysis to reduce adverse effects and compare trade-offs for the decision maker and public to understand. Issues were identified through scoping. Significant issues were defined as those directly or indirectly caused by implementing the proposed action, involve potentially significant effects, and could be meaningfully and reasonably evaluated and addressed within the programmatic scope of a forest plan. Some issues are best resolved at finer scales (subsequent environmental analysis) where the site-specific details of a specific action and resources it affects can be meaningfully evaluated and weighed. Conversely, some issues have already been considered through broader programmatic environmental analysis (such as the Northern Rockies Lynx Management Direction (NRLMD) Final Environmental Impact Statement). In these cases, the issues focus on evaluating the effects unique to and commensurate with the decisions being considered here.

In many cases, plan direction was revised in response to comments, and the revised direction is included in all of the revised plan alternatives.

Revised plan alternatives were developed around those significant issues that involved unresolved conflicts concerning alternative uses of available resources (40 CFR 1500.2(e)). The Custer Gallatin National Forest identified the following significant issues during scoping that drove alternative development.

2.4.1 Issues that Drove Alternatives

Forest Plan Land Allocations and Allowed Uses

The allocation of recommended wilderness areas was a primary issue for many of the public commenters. Public comments regarding recommended wilderness areas ranged from commenters asking the national forest to consider all existing inventoried roadless areas for recommended wilderness areas, or to include all possible lands from the wilderness inventory. At the other end of the spectrum, commenters desired no recommended wilderness areas. Many commenters recommended the consideration of additions, boundary modifications, or deletions to specific areas that were identified in the proposed action. Commenters also provided recommendations on types of uses they wished to be allowed or not allowed in recommended wilderness areas.

The proposed action included seven backcountry areas, with direction to maintain the generally undeveloped or lightly developed character of these areas. Public comments proposed additional backcountry areas, different boundaries, and allowed uses in backcountry areas.

The proposed action included eight recreation emphasis areas; these are areas offering a variety of quality recreation opportunities for a wide range of users and challenges to a wide range of skills. Public comments proposed additional recreation emphasis areas, different boundaries, and different allowed uses in recreation emphasis areas.

In addition to the issue of the amount and location of recommended wilderness areas and backcountry areas, whether or not to allow motorized recreation and mechanized recreation (such as bicycles) within these areas was also a primary concern of many public comments. Comments included those in favor of prohibiting motorized and mechanized means of transport within recommended wilderness areas or certain backcountry areas, as well as those that desire to continue these uses unless the recommended wilderness areas are formally designated by Congress. Some motorized users do not want to see further restrictions on motorized recreation. The mountain bike community was concerned about the potential loss of access to areas that they currently use, or requested additional areas be available for mountain biking use. To address these public concerns, alternatives vary in whether motorized or mechanized recreation is suitable in recommended wilderness area, and alternatives vary in the configuration of recommended wilderness area boundaries to include or exclude certain trails that allow motorized or mechanized recreation. Alternatives vary in whether motorized or mechanized recreation is suitable in the Pryor Mountain backcountry areas, and whether mechanized recreation is suitable in the Bad Canyon Backcountry Area.

Some commenters requested more motorized recreation opportunities. The recreation opportunity spectrum (ROS) is a classification tool used by Forest Service managers to provide visitors with varying challenges and outdoor experiences. Recreation opportunity spectrum classifies National Forest lands into six management class categories defined by setting and the probable recreation experiences and activities it affords including: urban; rural; roaded natural; semi-primitive motorized; semi-primitive non-motorized; and primitive. The recreation opportunity spectrum varies by alternative in concert with the varying forest plan allocations; with alternatives varying in the amount of motorized recreation opportunity spectrum acreage.

While not a topic of high public interest, inclusion of the Stillwater Complex as a land allocation varies by alternative as needed to be consistent with the overall theme of an alternative.

Measurement indicators:

- number of recommended wilderness areas, acres of recommended wilderness areas, uses allowed or not allowed in recommended wilderness areas, miles of motorized and mechanized trails no longer available in recommended wilderness areas, and acres of winter motorized recreation opportunity no longer available in recommended wilderness areas

- number of backcountry areas, acres of backcountry areas, uses allowed in backcountry areas, miles of motorized and mechanized trails no longer available in backcountry areas and acres of winter motorized recreation opportunity no longer available in backcountry areas
- number of recreation emphasis areas and acres of recreation emphasis areas
- inclusion of the Stillwater Complex land allocation
- acres in each recreation opportunity spectrum class

Wildlife: Bison, Bighorn Sheep and Connectivity

Many commenters desired that bison and bighorn sheep be designated as species of conservation concern or focal species. Commenters also provided feedback on plan direction for bison and bighorn sheep. While the designation of any species as a species of conservation concern cannot vary by alternative, bison plan direction varies by alternative to reflect tradeoffs between management for wildlife or livestock.

Commenters also identified substantial declines in bighorn sheep populations and distribution, including extirpation from parts of the national forest. Commenters were concerned about potential disease transmission from domestic sheep and goats to bighorn sheep. To address these concerns, alternatives vary in their approach to permitted domestic sheep and goat grazing, to recreational goat packing, and to agency use of domestic sheep and goats for weed control.

The 2012 Planning Rule requires the revised plan to address connectivity; this topic was also a subject of public comments. All revised plan alternatives have forestwide plan components to address connectivity, and in addition, revised plan alternatives vary by inclusion of “key linkage areas.”

Measurement indicators:

- level of proactive Forest Service management related to bison
- areas where permitted domestic sheep and goat grazing would be allowed use
- areas where permitted recreational goat packing would be allowed use
- areas where public recreational goat packing would be suitable use
- areas where agency use of domestic sheep and goats for weed control would be allowed
- inclusion of key linkage areas

Timber Harvest and Timber Production

Timber harvest and production was raised as an issue by public commenters. This topic includes the identification of lands suitable for timber production, estimated volume outputs of timber, and timber harvest conducted both for timber production and for other purposes. The comments included requests to increase the amount of lands suitable for timber production, increase timber volume offered from National Forest System lands, and increase the number of acres treated with harvest. Conversely, other commenters requested that few or no lands be suitable for timber production, and that less timber harvest occurs on National Forest System lands.

Measurement indicators:

- acres suitable for timber production
- acres unsuitable for timber production where harvest may occur for other purposes
- volume for projected timber sale quantity (PTSQ)
- projected wood sale quantity (PWSQ),
- acres of projected vegetation management (both fuels and timber harvest)

Objectives

Commenters requested that objectives for many resources be increased, such as weed treatment or trail maintenance. An objective is a concise, measurable, and time-specific statement of a desired rate of progress toward a desired condition or conditions. More objectives, or a higher objective for a particular resource would mean a faster rate of progress to a desired condition, while fewer objectives or a lower objective would mean a slower rate of progress to a desired condition. Objectives should be based on reasonably foreseeable budgets and they are determined through a trend analysis of the past three to five years of national forest budgets. Therefore, if objectives for some resource desired conditions increase, objectives for other resource desired conditions would need to decrease. Alternatives vary objectives, consistent with the theme of that alternative, while maintaining constant budget assumptions across all alternatives. Objectives are expected minimum achievements and could be exceeded with additional funding, additional authorities, or partnership opportunities.

Measurement indicators:

- numerical objectives described in table 9, objectives by alternative

Aircraft Landing Strips

Many commenters desired that recreational backcountry landing strips be acknowledged as an allowed use of the national forest. Other commenters requested the use not be allowed. Alternatives vary on the locations where recreational backcountry landing strips are allowed.

Measurement indicators:

- acres available for aircraft landing strips

2.4.2 Issues that Did Not Drive Alternatives

Other issues were raised both internally and externally. In many cases, plan direction was revised in response to internal and external comments, and the revised direction is included in all of the revised alternatives. While these issues did not drive the development of alternatives (other than aspects of issues described above), they are important elements of the analysis in this document.

These issues include but are not limited to:

- air quality
- soils
- water supply and quality
- riparian areas

- fisheries
- spread and control of invasive plants (weeds and aquatic invasive species)
- role of fire management, including fire suppression, the identification of high value resources, fire suppression, and wildland urban interface (WUI) considerations
- natural range of variation (NRV) of vegetation conditions
- specific vegetation components (such as old growth, snags, and large trees)
- condition of specific plant species or types (whitebark pine, aspen, sagebrush, non-forested plant communities, spruce and fir)
- carbon storage
- at-risk (federally listed threatened, endangered, proposed and candidate species and species of conservation concern) plant and animal species
- wildlife species diversity and viability of species
- availability of certain wildlife species for hunting, trapping, viewing and other human uses
- areas of tribal interest
- cultural and historical resources
- livestock grazing
- infrastructure (such as roads, trails, facilities, and dams)
- recreation special uses, outfitter guides, permitted recreation facilities and uses (such as ski areas, organizational camps, events, group use), developed and dispersed recreation
- scenic integrity objectives
- congressionally or administratively designated areas
- access and land status

2.5 Alternatives

The range of alternatives developed and presented is based on an evaluation of the information gathered from public and internal comments and the purpose and need. While all alternatives provide a wide range of ecosystem services and multiple uses, some give greater emphasis to selected resources based on the theme of the alternative and response to revision topics.

The revised plan alternatives were developed based on the Custer Gallatin National Forest’s assessment (2016); the need for change; desired conditions; implementation and monitoring of the current forest plans; public, agency, and tribal input; and comments received during the public scoping period. The alternatives represent a range of possible management options from which to choose. Each alternative emphasizes specific land and resource uses and de-emphasizes other uses in response to the revision topics. Some components may vary between alternatives to address the issues identified during scoping; (the description of the alternatives provides specific details). Plan direction for desired conditions, goals, standards, and guidelines typically remains constant for all revised plan alternatives, with the exceptions noted.

In addition to the no-action alternative (A) (often referred to as the current plans in this document) and the proposed action (B), which was modified based on public and internal comments, three additional alternatives (C, D, and E) were developed based on the identified issues. The alternatives span the range of forest management practices and uses of available resources. The general theme and intent of each alternative is summarized below, in relationship to the issues that drove alternatives. A limited number of plan components vary by alternative.

2.5.1 Elements Common to All Alternatives

All alternatives adhere to the principles of multiple use and the sustained yield of goods and services required by the Code of Federal Regulations (36 CFR 219.1 (b)). All alternatives are designed to:

- meet law, regulation, and policy;
- contribute to ecological, social, and economic sustainability;
- provide sustainable levels of products and services;
- provide integrated direction as included in the plan components;
- allow reasonable access and mineral development for private mineral rights (locatable mining claims, reserved and outstanding rights) and existing oil and gas leases on the national forest and consistent with subject laws and regulations;
- retain the existing decisions for the Northern Rockies Lynx Management direction and Grizzly Bear Conservation Strategy direction;
- manage the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area consistent with the Montana Wilderness Study Act of 1977 (unless released by Congress) and the 2001 Roadless Area Conservation Rule (Roadless Rule);
- retain all existing permitted activities and facilities;
- do not make oil and gas leasing decisions; and
- Do not make minerals withdrawal decisions

2.5.2 Elements Common to all Revised Plan Alternatives

In addition, under the revised plan alternatives:

- Plan direction would be consistent with the 2012 Planning Rule and associated directives, and emphasize adaptive management and consider the best available scientific information;
- Plan direction would meet the purpose and need for change and address one or more significant issues;
- Plan direction would provide direction that is consistent with existing travel plans, except where suitability for motorized recreation and mechanized recreation varies by revised plan alternatives. Site-specific travel decisions needed to bring travel plans into compliance with the revised forest plan would occur subsequent to the revised forest plan decision;
- designations and plan components would remain constant for designated wilderness; the designated East Rosebud Wild and Scenic River; Pryor Mountain Wild Horse Territory; research natural areas; special areas; National Natural Landmarks; the Earthquake Lake Geologic Area; National Scenic, Historic, and Recreation Trails; and the Beartooth Highway;
- thirty eligible wild and scenic rivers and their plan components would remain constant;

- a range of options would be provided if the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area were released by Congress. Inventoried roadless area direction would continue to apply in this area;
- plan components that provide the ecological conditions to support the persistence of species of conservation concern remain constant for all revised plan alternatives. Regional Forester sensitive species and management indicator species would no longer be in place under the revised plan alternatives.

2.5.3 Alternative A – No Action (the Current Plans)

Alternative A, the no-action alternative, is also referred to as the current plans throughout this document. Alternative A reflects current direction under the 1986 and 1987 forest plans, as amended, and provides the basis for comparing alternatives to current management and levels of output. Alternative A does not address some of the elements associated with the 2012 Planning Rule, such as the natural range of variation of vegetation conditions, habitat connectivity or the conservation watershed network. The Council on Environmental Quality regulations (40 CFR 1502.14d) requires that a "no action" alternative be analyzed in every environmental impact statement (EIS). This does not mean that nothing would occur under alternative A. The current conditions as described by each resource in chapter 3 would continue. Under this alternative, current management plans would continue to guide management of the national forest, and ongoing work or work previously planned and approved would occur under that guidance. Laws and regulations that have been adopted since the 1986 and 1987 plans will be analyzed as part of the no-action alternative (for example, the designation of inventoried roadless areas). With respect to the identified issues, the alternative is described as follows:

- There are seven recommended wilderness areas (Lost Water Canyon, Line Creek Plateau, Red Lodge Creek/Hellroaring, Mystic Lake, Burnt Mountain, Republic Mountain, and Lionhead.)
- There are three "low development areas" in the Ashland Geographic Area (King Mountain, Cook Mountain, and the Tongue River Breaks), similar to the backcountry areas proposed in the revised plan alternatives.
- There are land allocations for travel corridors with heavy recreation use (portions of the Gallatin Canyon, Boulder River, Yankee Jim Canyon of the Yellowstone River, highway U.S. 212 in the Cooke City vicinity, highways U.S. 191 and U.S. 287 in the West Yellowstone vicinity, and areas adjacent to Hebgen Lake and Hyalite Reservoir, as well as most access corridors to developed recreation sites on the former Custer National Forest.)
- The Hyalite-Porcupine-Buffalo Horn Wilderness Study Area would continue to be managed consistent with the Montana Wilderness Study Act of 1977 and the 2001 Roadless Rule. In Alternative A, the current Gallatin Forest Plan, Gallatin Travel Plan, and inventoried roadless area direction would apply if the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area were released by Congress.
- There are land allocations for minerals activity.
- Existing motorized recreation and mechanized recreation is allowed in all areas currently allowed. Mechanized recreation is allowed in the Lionhead Recommended Wilderness Area.
- Eleven eligible wild and scenic rivers are managed to continue their protection of identified outstandingly remarkable values, tentative classifications and free-flowing nature.

- No specific bison management direction is stated in the current forest plans, although the forest would continue bison management in conjunction with partners under the Interagency Bison Management Plan.
- While no specific management direction is stated related to disease transmission to bighorn sheep from domestic sheep and goats, the Forest Service would follow current policy to only allow this use if a risk assessment indicates risk of disease transmission to bighorn sheep can be minimized.
- Lands suitable for timber production are based on the 1986 and 1987 plans as amended, with current regulation and policy. When consistent with other plan components, harvest for purposes other than timber production could occur on a subset of unsuitable lands.
- Plan objectives are based on national forest accomplishments from 2014 through 2017 and reflect a mix of resource enhancement, timber and wood products volume, hazardous fuel treatment, road, trail and facility maintenance, and new recreation facilities.
- Aircraft landing strips are allowed in certain areas subject to Forest Service permitting.

2.5.4 Alternative B

Alternative B is based on the detailed proposed action that was published with the notice of intent in January 2018, with modifications in response to scoping comments and internal Forest Service review. It is the result of public engagement efforts since 2016 and represents a mix of recommended wilderness areas, backcountry areas, recreation emphasis areas, and lands identified as suitable for timber production. With respect to the identified issues, the alternative is described as follows:

- There would be nine recommended wilderness areas (Lost Water Canyon, Line Creek Plateau, Red Lodge/Hellroaring, Mystic Lake, Republic Mountain, Gallatin Crest, Sawtooth, Taylor Hilgard, and Lionhead.)
- There would be nine backcountry areas (King Mountain, Cook Mountain, the Tongue River Breaks, Punch Bowl, Big Pryor, Bear Creek, Bad Canyon, Buffalo Horn, and Cowboy Heaven).
- There would be eight recreation emphasis areas (Main Fork Rock Creek, Boulder River, Cooke City Winter, Yellowstone River, Hyalite, Gallatin Canyon, Hebgen Lakeshore, and Hebgen Winter).
- The Hyalite-Porcupine-Buffalo Horn Wilderness Study Area would continue to be managed consistent with the Montana Wilderness Study Act of 1977 and the 2001 Roadless Rule. If the wilderness study area were released by Congress, portions of the wilderness study area would have land allocations of recommended wilderness area, backcountry area and recreation emphasis areas; a portion would be managed under inventoried roadless area direction.
- There would be a Stillwater Complex land allocation for minerals.
- Existing motorized recreation and mechanized recreation use, and continued use of existing commercial communication facilities would be suitable in recommended wilderness areas.
- Other non-wilderness uses would not be allowed in recommended wilderness areas, such as existing or new use of cabins as recreation rentals, new recreation events such as races, and new commercial communication facilities.
- Plan components would support management of bison on the Custer Gallatin National Forest.

- New permitted domestic sheep and goat grazing, and permitted and non-permitted recreational goat packing would not be allowed in the Madison, Henrys Lake, and Gallatin Mountains, the Absaroka-Beartooth Mountains, and the Pryor Mountains Geographic Areas. Elsewhere on the national forest, permitted domestic sheep and goat grazing, and permitted recreational goat packing would be allowed only if a risk assessment indicated risk of disease transmission to bighorn sheep can be minimized. Forestwide, use of domestic sheep and goats for weed control would be allowed only if a risk assessment indicated risk of disease transmission to bighorn sheep can be minimized.
- In addition to forestwide plan components that address connectivity, key linkage areas are included in the northern end of the Gallatin Mountains and the west side of the Bridger Mountains.
- All lands that were are not withdrawn from timber suitability due to legal or technical factors (for example, designated wilderness) would be suitable for timber production except for research natural areas, special areas, the Pryor Mountain Wild Horse Territory, the Continental Divide National Scenic Trail, recommended wilderness areas, backcountry areas, eligible wild and scenic rivers, National Natural Landmarks, and riparian management zones. When consistent with other plan components, harvest for purposes other than timber production could occur on other lands not suitable for production.
- Plan objectives reflect a mix of resource enhancement, moving toward forested vegetation desired conditions, timber and wood products volume, hazardous fuel treatment, road, trail and facility maintenance, and new recreation facilities.
- Aircraft landing strips would be allowed in certain areas subject to Forest Service permitting.

2.5.5 Alternative C

Alternative C also represents a mix of recommended wilderness areas, backcountry areas, recreation emphasis areas, and lands identified as suitable for timber production. The alternative reflects the Gallatin Forest Partnership proposal for the Gallatin and Madison Mountains. The alternative omits most mountain biking trails from boundaries of the Lionhead Recommended Wilderness Area in response to public interest. It also reflects public input for the uses in the Pryor Mountains Backcountry Areas, and backcountry areas for the Crazy Mountains, West Bridgers, and Blacktail Peak. With respect to the identified issues, the alternative is described as follows:

- There would be nine recommended wilderness areas (Lost Water Canyon, Line Creek Plateau, Red Lodge/Hellroaring, Mystic Lake, Republic Mountain, Gallatin, Cowboy Heaven, Taylor Hilgard, and Lionhead.)
- There would be twelve backcountry areas (King Mountain, Cook Mountain, the Tongue River Breaks, Punch Bowl, Big Pryor, Bear Creek, Bad Canyon, Buffalo Horn, West Pine, Crazy Mountains, West Bridgers, and Blacktail Peak). Suitable uses in some backcountry areas vary from alternative B.
- There would be eight recreation emphasis areas as listed for alternative B. The Hyalite Recreation Emphasis Areas would be larger in Alternative C than Alternative B.
- The Hyalite-Porcupine-Buffalo Horn Wilderness Study Area would continue to be managed consistent with the Montana Wilderness Study Act of 1977 and the 2001 Roadless Rule. If the wilderness study area were released by Congress, the entire wilderness study area would continue to be managed as an inventoried roadless area. In Alternative C, proposed land allocations for nearly

all of the wilderness study area would include recommended wilderness area, backcountry area, and recreation emphasis area; a portion would be managed under inventoried roadless area direction.

- There would be a Stillwater Complex land allocation for minerals.
- Motorized recreation and mechanized recreation use and continued use of existing commercial communication facilities would not be suitable in recommended wilderness areas.
- Other non-wilderness uses would not be allowed in recommended wilderness areas, such as new recreation events and new commercial communication facilities. The use of the Windy Pass cabin as a recreation rental would continue.
- Plan components would support management of bison on the Custer Gallatin National Forest.
- Plan components for new permitted domestic sheep and goat grazing, permitted and non-permitted recreational goat packing, and use of domestic sheep and goats for weed control are the same as described in alternative B.
- In addition to forestwide plan components that address connectivity, key linkage areas are included in the northern end of the Gallatin Mountains and the west side of the Bridger Mountains.
- The criteria used for the timber suitability and availability determinations would be the same as described for alternative B; except the Buffalo Horn, Punch Bowl, Big Pryor, and Bear Creek Backcountry Areas would not be available for timber harvest.
- Plan objectives reflect a similar mix of activities as described in Alternative B.
- Aircraft landing strips would be allowed in certain areas subject to Forest Service permitting.

2.5.6 Alternative D

Alternative D was developed to address comments and themes of emphasizing natural processes and restoration. This alternative would be responsive to commenters who desire more undeveloped recreation opportunities, and a more prominent role for natural ecological processes. This alternative includes the greatest amount of recommended wilderness areas, higher objectives for restoration, and less land suitable for timber production. With respect to the identified issues, the alternative is described as follows:

- There would be thirty nine recommended wilderness areas (listed from the eastern geographic areas to the western geographic areas): Cook Mountain, King Mountain, Tongue River Breaks, Bear Canyon, Big Pryor, Crooked Creek-Lost Water Canyon, Punch Bowl, Chico Peak, Deckard Flats, Deer Creek, Dome Mountain, East Rosebud to Stillwater, Emigrant Peak, Knowles Peak, Line Creek Plateau, Mount Rae, Mystic, North Fork, Phelps Creek, Red Lodge Creek, Republic, Sheep Creek, Strawberry Creek, Tie Creek, West Fork Rock Creek, West Woodbine, Crazy Mountains, Blacktail Peak, West Bridger, Buck Creek, Cabin Creek North, Cabin Creek South, Cowboy Heaven, Gallatin, Lionhead, Spanish Peaks East, Spanish Peaks South, Taylor Hilgard, and Yankee Jim Lake.
- There would be one backcountry area (Chalk Buttes).
- There would be four recreation emphasis areas (Main Fork Rock Creek, Yellowstone River, Hyalite, and Gallatin Canyon). The Yellowstone River, Hyalite, and Gallatin Canyon recreation emphasis areas would be smaller in Alternative D than in other alternatives.

- The Hyalite-Porcupine-Buffalo Horn Wilderness Study Area would continue to be managed consistent with the Montana Wilderness Study Act of 1977 and the 2001 Roadless Rule. If the wilderness study area were released by Congress, the entire wilderness study area would continue to be designated as an inventoried roadless area. In Alternative D, nearly the entire wilderness study area is proposed as recommended wilderness area.
- There would be no Stillwater Complex land allocation for minerals, yet mining would continue in the area.
- Motorized recreation and mechanized recreation would not be suitable uses in recommended wilderness areas.
- Other non-wilderness uses would not be suitable in recommended wilderness areas, such as use of cabins as recreation rentals, new recreation events, and commercial communication facilities.
- Plan components would support management of bison on the Custer Gallatin National Forest, including a year round self-sustaining bison population on the national forest.
- New permitted domestic sheep and goat grazing, permitted and public recreational goat packing, and use of domestic sheep, and goats for weed control would not be allowed.
- The criteria used for the timber suitability and availability determinations would be the same as described for alternative B.
- In addition to forestwide plan components that address connectivity, key linkage areas are included in the northern end of the Gallatin Mountains and the west side of the Bridger Mountains.
- Plan objectives would emphasize resource enhancement, moving toward forested vegetation desired conditions, hazardous fuel treatment, and moving toward wilderness character. Objectives would deemphasize road and trail maintenance, and new recreation facilities. This alternative proposes a lower timber and wood products volume.
- Aircraft landing strips would not be allowed on the national forest.

2.5.7 Alternative E

Alternative E was developed to address comments and themes of higher human presence and use of the national forest, additional recreation emphasis areas, increasing timber production from National Forest System lands, additional motorized and mechanized recreation opportunities, and not including any recommended wilderness areas. With respect to the identified issues, the alternative is described as follows:

- There would be no recommended wilderness areas.
- There would be two backcountry areas (Buffalo Horn and Lionhead).
- There would be twelve recreation emphasis areas (Main Fork Rock Creek, West Fork Rock Creek/Red Lodge Mountain, Boulder River, Cooke City Winter, Yellowstone River, Hyalite, the M, Bridger Winter, Storm Castle, Gallatin Canyon, Hebgen Lakeshore, and Hebgen Winter).
- The Hyalite-Porcupine-Buffalo Horn Wilderness Study Area would continue to be managed consistent with the Montana Wilderness Study Act of 1977 and the 2001 Roadless Rule. If the wilderness study area were released by Congress, the entire wilderness study area would continue

to be managed as an inventoried roadless area. In Alternative E, the entire wilderness study area would become a backcountry area.

- There would be a Stillwater Complex land allocation for minerals.
- There would be no loss to existing motorized recreation or mechanized recreation. Additional opportunity for motorized and mechanized recreation use would be provided.
- Plan components would support management of bison on the Custer Gallatin National Forest, but in a less proactive manner than other revised plan alternatives.
- New permitted domestic sheep and goat grazing, permitted recreational goat packing and use of domestic sheep and goats for weed control would be allowed only if a risk assessment indicated risk of disease transmission to bighorn sheep can be minimized. Public recreational goat packing would be a suitable use.
- Forestwide plan components address connectivity; this alternative does not include key linkage areas.
- The criteria used for the timber suitability and availability determinations would be the same as described for alternative B, except no recommended wilderness areas are included in alternative E.
- Plan objectives would emphasize timber and wood products volume. The additional Forest Service funding needed to accomplish the higher timber volume would result in lower objectives for resource enhancement, hazardous fuel treatment, moving toward wilderness character, and road and trail maintenance.
- Aircraft landing strips would be allowed in certain areas subject to Forest Service permitting.

2.5.8 Alternatives Considered, but not Given Detailed Study

The Council on Environmental Quality requires Federal agencies to briefly discuss the reasons for eliminating any alternatives that were not developed in detail (40 CFR 1502.14 (a). Public comments received during scoping provided suggestions for alternative methods for achieving the purpose and need for action. Some of these alternatives were outside the scope of the purpose and need for action, duplicative of the alternatives considered in detail, or determined to be components that would cause unnecessary harm. The alternatives provided by the public (in bold) and the subsequent agency rationale as to why they were not given further detailed study are described below.

All Inventoried Roadless Areas (inventory roadless areas) should be recommended wilderness: Not all of the lands designated as inventory roadless area were contained in the wilderness inventory, and only lands in the wilderness inventory can be considered for recommended wilderness. Some of the lands designated as inventory roadless area have roading or other developments that made portions of inventory roadless areas ineligible for the wilderness inventory. Of the lands designated inventory roadless area that were contained in the wilderness inventory, some inventory roadless areas or portions of inventory roadless areas were not recommended as wilderness in any alternative because of unmanageable boundaries or small size. Detailed rationale of the wilderness inventory is documented in appendix D of the 2018 Proposed Action (https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd567792.pdf) and detailed rationale for areas excluded from recommended wilderness in any of the alternatives considered in detail is documented in appendix D of this document.

All areas in the wilderness inventory should be recommended wilderness: Not all of the lands in the wilderness inventory are included as recommended wilderness in any of the alternatives considered in detail for the following reasons. Detailed rationale is documented in appendix D of this document.

- Each area recommended as wilderness in any alternative considered in detail must have a clearly defined boundary that supports management of the area for wilderness and other adjacent uses (FSH 1909.12 Chapter 70). Boundaries should be easy to identify and locate on the ground and may use locatable natural features (for example, ridges and perennial streams), locatable human features and setbacks from locatable human features (for example, roads, trails, and powerlines), boundary lines, section lines, lines between locatable points, or a metes and bounds survey. Once manageable boundaries were established, some areas larger than 5,000 acres in the wilderness inventory were smaller than 5,000 acres; too small to be recommended wilderness area.
- Many areas less than 5,000 acres were included in wilderness inventory because they are attached to existing designated wilderness or lands managed as wilderness by other Federal agencies. Small areas attached to other federal lands tend to be surrounded by non-wilderness use and difficult to manage for wilderness character.
- Small additions to existing designated wilderness areas would result in less manageable boundaries than the boundaries in existence for the past 30 years, unless small additions were well defined blocks of land.
- In the Sioux, Ashland, and Pryors Geographic Areas, the wilderness character of wilderness inventory areas is affected by the density of all motor vehicle trails, which may be under permit for motorized access for grazing infrastructure, and some routes are through-routes used for access beyond the forest boundary.

The Cabin Creek Recreation and Wildlife Area should be recommended wilderness. Congress has already decided the designation of this area; therefore the Forest Service does not have the authority to propose a different land allocation.

Recommended wilderness should be at least two miles from state and private land. A two-mile distance from state and private land can be calculated for the recommended wilderness in any detailed alternative, therefore the proposed configuration of recommended wilderness is included in the detailed alternatives as a smaller area of recommended wilderness than displayed.

The area around Big Sky should be a recreation emphasis area. The national forest land near Big Sky is either wilderness or small, disjointed areas of rural recreation opportunity spectrum that do not comprise a cohesive manageable recreation emphasis areas. Therefore, this alternative was not considered in a detailed analysis.

The West Bridgers should be a recreation emphasis area. The area does not meet intent for recreation emphasis areas, which are areas with high use and a variety of uses. Therefore, this alternative was not considered in a detailed analysis. However, other allocations for the West Bridgers vary in the detailed alternatives.

A number of additional rivers should be identified as eligible wild and scenic rivers. To be eligible as a wild and scenic river in the forest plan, a river or stream must have one or more outstandingly remarkable value (ORV) in the region of comparison. Comments requesting additional rivers did not:

- include a description of the region of comparison
- define every category of outstandingly remarkable value
- state the criteria used to determine that a river should be found eligible
- list the outstandingly remarkable value that would be used to qualify the river
- explain why the river was unique or exemplary within the region of comparison
- list an outstandingly remarkable value meeting the definition used by the Forest Service. For example, a comment might state that bison use a river corridor, which was not part of the Forest Service outstandingly remarkable value definition for wildlife.

The proposed additional streams and rivers were not rare, unique, or exemplary when considered based on the regions of comparison, nor with the definitions of the outstandingly remarkable values. Since the finding of an “eligible river” does not change by alternative, other rivers found not to meet the criteria were dropped from further study. Public comments did lead to a change in the tentative classification of one river.

No rivers, or fewer rivers, should be identified as eligible wild and scenic rivers. Comments did not provide rationale related to outstandingly remarkable values in the region of comparison that would lead to different determination of eligibility. Some comments raised issues appropriate for a suitability study, such as potential trade-offs related to a potential wild and scenic river designation. A suitability study is not being undertaken with this plan revision process. Since the finding of an “eligible river” does not change by alternative, none of the rivers listed as eligible in the 2018 Proposed Action were dropped from the draft revised plan.

The Pryor Mountain Wild Horse Territory should be expanded. Expansion of the Pryor Mountain Wild Horse Territory is beyond the scope of the forest plan revision. Wild horses can only be managed on areas of public lands where they were known to exist in 1971, at the time of the passage of the Wild Free-Roaming Horses and Burros Act (Forest Service territories and Bureau of Land Management herd areas). Under section 1339 “Limitation of Authority” the Wild Free-Roaming Horses and Burros Act of 1971 states “Nothing in this Act shall be construed to authorize the Secretary to relocate wild free-roaming horses or burros to areas of the public lands where they do not presently exist.” Until a change in the law allows for expansion of the Pryor Mountain Wild Horse Range onto additional U.S. Forest Service and Bureau of Land Management lands that are outside of the territory and herd area, the agencies have a legal obligation to follow the law. Horses were in the Pryor Mountains historically, but by 1968 they were largely limited to the 1968 designated range due to the U.S. Forest Service/Bureau of Land Management boundary fence. Though there is some supposition as to the extent of wild horses in 1971, comprehensive agency inventories in 1971-1972, U.S. Forest Service and Bureau of Land Management assessments, and public involvement in 1972-1973 provided the basis for territory and herd area boundaries per the 1971 Act. Subsequent land use planning efforts in 1984 (Bureau of Land Management) and 1987 (U.S. Forest Service) validated the same areas as being wild horse herd management area and territory, respectively. Therefore, expansion of the Pryor Mountain Wild Horse Territory was not considered in a detailed analysis.

There should be more minerals special emphasis areas similar to the Stillwater Complex. The Stillwater Complex is very unique in the minerals available and level of ongoing mineral development and is where most future minerals proposals are expected. Others areas of the national forest do not have the same level of unique minerals or expected level of development. Therefore, additional mineral land allocations were not delineated in a detailed alternative.

The Emigrant and Crevice Mountain Potential Mineral Withdrawal area (about 30,370 acres) should have a special emphasis land allocation with direction for the scenic integrity, important wildlife corridors and high recreation values of the area. Forestwide plan direction addresses scenic integrity, wildlife, and recreation. Therefore, commenters concerns are included in the detailed alternatives.

Lionhead should be designated as a national recreation area. A national recreation area designation is beyond the authority of the Forest Service. A number of land allocations were proposed by the public for Lionhead, with the underlying issue whether mountain biking is allowed in the area. The alternatives considered in detail, including no action, provide a range of options for addressing mountain bike use in Lionhead.

The Crazy Mountains and the Pryor Mountains should be allocated as tribal special emphasis areas. A tribal special emphasis area land allocation may or may not be sought by tribes. No tribe has requested that any area of the national forest be identified as a tribal special emphasis area. Plan direction in all detailed alternatives addresses tribal uses and protection of cultural and historical resources on the Custer Gallatin.

Wildland urban interface (WUI) areas should be allocated as special emphasis areas. The wildland urban interface areas are not suitable for a specific wildland urban interface land allocation because wildland urban interface locations could change over time due to new development near the national forest boundary, new methods of mapping wildland urban interface, the evolving science of predicting fire impacts to community values, and county updates to wildland urban interface maps (counties are responsible for wildland urban interface maps, and update the maps updated every 5 to 10 years). Although a detailed alternative that delineates a specific plan allocation is not considered, plan components would apply in locations that meet the wildland urban interface criteria.

The Ashland District should be allocated as a grazing special emphasis area. The Distinct Roles and Contributions section for the Ashland Geographic Area acknowledges that the district manages one of the largest national forest livestock grazing programs. Others areas of the national forest have the same level of expected administrative needs and issues with permitted grazing. Other multiple uses are legitimate uses of the Ashland unit and to single out livestock grazing as an emphasis area for the entire district would not meet the principles of multiple use, sustained yield. Therefore, this alternative was not considered in a detailed analysis.

An alternative should include no permitted livestock grazing. Adjustments to livestock use have been incorporated into the alternatives considered in detail, as appropriate, in order to address identified issues with livestock management. Since the national forest has considerable discretion, through its livestock grazing regulations, to determine and adjust stocking levels, seasons-of-use, and livestock grazing management activities, as well as to allocate forage, the detailed analysis of an alternative to entirely eliminate livestock grazing is not needed. A detailed alternative that proposes to close the entire national forest to livestock grazing would also be inconsistent with the intent of the Granger-Thye Act of 1950, Multiple Use Sustained Yield Act of 1960, Forest and Rangeland Renewable Resources Planning Act of 1974, the Wilderness Act of 1964, National Forest Management Act of 1976, Public Rangelands Improvement Act of 1978, and the Rescission Act of 1995 which directs the Forest Service to provide for livestock use of national forest administered lands; to provide for the orderly use, improvement, and development of the range; and to stabilize the livestock industry dependent upon the public range. The multiple-use mandate does not require that all lands be used for livestock grazing; however, complete removal of livestock grazing on the entire national forest would not meet the principles of multiple-use and sustained-yield management. Livestock grazing is and has been an important use of the public lands in the planning area for many years and is a continuing government program. For these reasons, an alternative of no livestock grazing for the entire national forest was not considered in a detailed analysis.

An alternative should include a reduction in permitted livestock grazing. It is not appropriate at the three million acre programmatic forest planning scale to determine the number of animal unit months that any individual allotment can support due to the need for site-specific inventory, monitoring and condition information. In addition, this alternative would be counter to Forest Service Handbook 1909.12, sections 22.13 and 22.14 which directs that plan components should not direct or compel processes such as analysis, assessment, inventory, or monitoring. Objectives for forestwide animal unit months vary by alternative based on potential disposition of vacant allotment animal unit months. There this alternative was not considered in a detailed analysis.

An alternative should allow very limited management. An alternative of very limited management would not meet the laws, regulations and policies that guide the multiple use management of national forests.

The Forest Service should manage wildlife instead of the States of Montana and South Dakota. Based upon Forest Service Manual 2643.1, hunting, fishing, and trapping of fish and wildlife and associated practices on National Forest System lands are subject to State fish and wildlife laws and regulations unless they conflict with Federal laws or would permit activities that conflict with the land and resource management responsibilities of the Forest Service. Although the national forest has the authority to restrict hunting and trapping on National Forest System lands, the national forest knows of no scientific evidence indicating that impacts from hunting and trapping would warrant this restriction. The range of alternatives considered is responsive to 2012 Planning Rule requirements for ecological, social, and economic sustainability and the multiple-use requirements of the Forest Service.

The Forest Service does not have the capacity to manage the functions now managed by the States, such as hunting, fishing, trapping, poaching enforcement, aquatic invasive species watercraft inspections, etc. Through partnership with the States, the Forest Service is able to extend the reach of resource enhancement, such as native fish and wildlife reintroduction. Therefore, this alternative was not considered in a detailed analysis.

2.6 Comparison of Alternatives

Table 2 through table 8 compare alternatives by issue, first at the forestwide scale and then for each geographic area. Issues that are not applicable to a given geographic area are omitted from the table (for example, if no recommended wilderness areas are identified under any alternative, or if no trail use is affected under any alternative, those indicators are not listed for that geographic area). Some issues are not relevant to display at the geographic area scale, such as bison management and objectives. Acreages and mileages are rounded to the nearest whole number. Alternative A represents the current plans.

Table 2. Forestwide comparison of issues by alternative

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness number	7	9	9	39	0
Recommended wilderness acres	33,741	113,952	146,555	711,425	0
Backcountry area number	3	9	12	1	2
Backcountry area acres	38,414	125,090	252,896	5,937	173,266
Recreation emphasis area number	0	8	8	4	12
Recreation emphasis area acres	0	178,094	208,718	34,649	213,258
Stillwater complex acres	0	102,945	102,945	0	102,945
Miles motorized trail no longer available	0	0	4	172	0
Miles mechanized trail no longer available	0	0	20	256	0
Acres winter motorized recreation use no longer available	0	0	24,885	232,985	0
Forested acres suitable for timber production; percent Custer Gallatin National Forest	665,247 22%	582,338 19%	570,146 19%	553,950 18%	604,502 20%
Forested acres unsuitable for timber production but where timber harvest may occur for other purposes; percent Custer Gallatin National Forest	523,883 17%	592,261 19%	563,839 19%	246,127 8%	608,056 20%
Bison	No plan direction	Proactive bison support	Proactive bison support	Most proactive bison support	Less proactive bison support
Bighorn sheep disease prevention Permitted use of domestic sheep or goats (grazing or outfitting)	No plan direction; risk assessment per policy.	Not allowed in Pryor, AB, or MHG GAs. Risk assessment elsewhere.	Not allowed in Pryor, AB, or MHG GAs. Risk assessment elsewhere.	Not allowed forestwide	Risk assessment
Bighorn sheep disease prevention Public use of recreational pack goats	No plan direction	Not suitable in Pryor, AB, or MGH GAs. Suitable elsewhere.	Not suitable in Pryor, AB, or MGH GAs. Suitable elsewhere.	Not suitable forestwide	Suitable forestwide
Bighorn sheep disease prevention Agency use of domestic sheep or goats for weed control	No plan direction; risk assessment per policy.	Risk assessment	Risk assessment	Not allowed forestwide	Risk assessment
Connectivity	No plan direction	Plan components and key linkage areas	Plan components and key linkage areas	Plan components and key linkage areas	Plan components
Aircraft landing strip acres	1,021,650	937,310	907,300	0	938,591

GA = geographic area; AB=Absaroka Beartooth Mountains Geographic Area; MHG=Madison, Henrys Lake, and Gallatin Mountains Geographic Area

Table 3. Sioux Geographic Area (GA) comparison of issues by alternative

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Backcountry area number	0	0	0	1	0
Backcountry area acres	0	0	0	5,937	0
Bighorn sheep disease prevention Permitted use of domestic sheep or goats (grazing or outfitting)	No plan direction; risk assessment per policy.	Risk assessment	Risk assessment	Not allowed	Risk assessment
Bighorn sheep disease prevention Public use of recreational pack goats	No plan direction	Suitable	Suitable	Not suitable	Suitable
Bighorn sheep disease prevention Agency use of domestic sheep or goats for weed control	No plan direction; risk assessment per policy.	Risk assessment	Risk assessment	Not allowed	Risk assessment
Forested acres suitable for timber production; percent of GA	65,958 40%	59,859 36%	59,859 36%	57,519 35%	59,859 36%
Forested acres unsuitable for timber production but where timber harvest may occur for other purposes; percent of GA	1,107 1%	7,206 4%	7,206 4%	9,545 6%	7,206 4%
Aircraft landing strips acres	163,269	146,116	146,116	0	146,116

Table 4. Ashland Geographic Area (GA) comparison of issues by alternative

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness number	0	0	0	3	0
Recommended wilderness acres	0	0	0	37,180	0
Backcountry area number	3	3	3	0	0
Backcountry area acres	38,414	38,414	38,414	0	0
Bighorn sheep disease prevention Permitted use of domestic sheep or goats (grazing or outfitting)	No plan direction; risk assessment per policy.	Risk assessment	Risk assessment	Not allowed	Risk assessment
Bighorn sheep disease prevention Public use of recreational pack goats	No plan direction	Suitable	Suitable	Not suitable	Suitable
Bighorn sheep disease prevention Agency use of domestic sheep or goats for weed control	No plan direction; risk assessment per policy.	Risk assessment	Risk assessment	Not allowed	Risk assessment
Forested acres suitable for timber production; percent of GA	196,123 45%	189,379 43%	189,379 43%	189,384 43%	189,529 43%
Forested acres unsuitable for timber production but where timber harvest may occur for other purposes; percent of GA	21,132 5%	27,877 6%	27,877 6%	8,956 2%	27,727 6%
Aircraft landing strips acres	402.557	386,487	373,587	0	386,487

Table 5. Pryor Mountains Geographic Area (GA) comparison of issues by alternative

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness number	1	1	1	4	0
Recommended wilderness acres	6,804	6,804	6,804	43,861	0
Backcountry area number	0	3	3	0	0
Backcountry area acres	0	29,389	29,389	0	0
Miles motorized trail no longer available	0	0	4	5	0
Miles mechanized trail no longer available	0	0	6	6	0
Acres winter motorized recreation use no longer available	0	0	16,001	21,866	0
Bighorn sheep disease prevention Permitted use of domestic sheep or goats (grazing or outfitting)	No plan direction; risk assessment per policy.	Not allowed	Not allowed	Not allowed	Risk assessment
Bighorn sheep disease prevention Public use of recreational pack goats	No plan direction	Not suitable	Not suitable	Not suitable	Suitable
Bighorn sheep disease prevention Agency use of domestic sheep or goats for weed control	No plan direction; risk assessment per policy.	Risk assessment	Risk assessment	Not allowed	Risk assessment
Forested acres suitable for timber production; percent of GA	32,888 44%	13,240 18%	13,240 18%	11,931 16%	28,635 38%
Forested acres unsuitable for timber production but where timber harvest may occur for other purposes; percent of GA	10,207 14%	26,945 36%	10,766 14%	6,267 8%	17,935 24%
Aircraft landing strips acres	49,489	44,149	29,587	0	44,347

Table 6. Absaroka Beartooth Mountains Geographic Area (GA) comparison of issues by alternative

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness number	5	4	4	19	0
Recommended wilderness acres	6,163	2,238	2,238	214,247	0
Backcountry area number	0	1	1	0	0
Backcountry area acres	0	18,722	18,722	0	0
Recreation emphasis area number	0	3	3	1	4
Recreation emphasis area acres	0	37,940	37,940	6,681	48,020
Stillwater Complex acres	0	102,945	102,945	0	102,945
Miles motorized trail no longer available	0	0	0	52	0
Miles mechanized trail no longer available	0	0	0	91	0
Acres winter motorized recreation use no longer available	0	0	0	99,000	0
Bighorn sheep disease prevention Permitted use of domestic sheep or goats (grazing or outfitting)	No plan direction; risk assessment per policy.	Not allowed	Not allowed	Not allowed	Risk assessment
Bighorn sheep disease prevention Public use of recreational pack goats	No plan direction	Not suitable	Not suitable	Not suitable	Suitable
Bighorn sheep disease prevention Agency use of domestic sheep or goats for weed control	No plan direction; risk assessment per policy.	Risk assessment	Risk assessment	Not allowed	Risk assessment
Forested acres suitable for timber production; percent of GA	96,744 7%	79,817 6%	79,817 6%	71,241 5%	85,737 6%
Forested acres unsuitable for timber production but where timber harvest may occur for other purposes; percent of GA	229,315 17%	249,976 18%	249,976 18%	97,434 7%	245,319 18%
Aircraft landing strips acres	171,971	154,782	154,782	0	155,181

Table 7. Bridger, Bangtail, Crazy Mountains Geographic Area (GA) comparison of issues by alternative

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness number	0	0	0	3	0
Recommended wilderness acres	0	0	0	91,889	0
Backcountry area number	0	0	3	0	0
Backcountry area acres	0	0	115,625	0	0
Recreation emphasis area number	0	0	0	0	2
Recreation emphasis area acres	0	0	0	0	5,502
Miles motorized trail no longer available	0	0	0	30	0
Miles mechanized trail no longer available	0	0	0	36	0
Acres winter motorized recreation use no longer available	0	0	0	38,836	0
Bighorn sheep disease prevention Permitted use of domestic sheep or goats (grazing or outfitting)	No plan direction; risk assessment per policy.	Risk assessment	Risk assessment	Not allowed	Risk assessment
Bighorn sheep disease prevention Public use of recreational pack goats	No plan direction	Suitable	Suitable	Not suitable	Suitable
Bighorn sheep disease prevention Agency use of domestic sheep or goats for weed control	No plan direction; risk assessment per policy.	Risk assessment	Risk assessment	Not allowed	Risk assessment
Connectivity	No plan direction	Plan components and key linkage areas	Plan components and key linkage areas	Plan components and key linkage areas	Plan components
Forested acres suitable for timber production; percent of GA	59,027 29%	51,808 25%	44,118 22%	50,963 25%	51,806 25%
Forested acres unsuitable for timber production but where timber harvest may occur for other purposes; percent of GA	87,828 43%	95,049 46%	102,737 50%	40,038 20%	95,049 46%
Aircraft landing strips acres	98,040	87,001	87,001	0	87,182

Table 8. Madison, Henrys Lake, Gallatin Mountains Geographic Area (GA) comparison of issues by alternative

Issue	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Recommended wilderness number	1	4	4	10	0
Recommended wilderness acres	20,774	104,910	137,513	324,248	0
Backcountry area number	0	2	2	0	2
Backcountry area acres	0	38,565	50,745	0	173,266
Recreation emphasis area number*	0	5	5	3	6
Recreation emphasis area acres*	0	140,155	170,776	27,977	159,736
Miles motorized trail no longer available	0	0	0	84	0
Miles mechanized trail no longer available	0	0	14	122	0
Acres winter motorized recreation use no longer available	0	0	8,884	73,283	0
Bighorn sheep disease prevention Permitted use of domestic sheep or goats (grazing or outfitting)	No plan direction; risk assessment per policy.	Not allowed	Not allowed	Not allowed	Risk assessment
Bighorn sheep disease prevention Public use of recreational pack goats	No plan direction	Not suitable	Not suitable	Not suitable	Suitable
Bighorn sheep disease prevention Agency use of domestic sheep or goats for weed control	No plan direction; risk assessment per policy.	Risk assessment	Risk assessment	Not allowed	Risk assessment
Connectivity	No plan direction	Plan components and key linkage areas	Plan components and key linkage areas	Plan components and key linkage areas	Plan components
Forested acres suitable for timber production; percent of GA	214,504 27%	188,237 23%	183,732 23%	172,911 21%	188,937 23%
Forested acres unsuitable for timber production but where timber harvest may occur for other purposes; percent of GA	174,294 22%	185,209 23%	165,278 21%	83,887 10%	214,820 27%
Aircraft landing strips acres	136,324	118,775	116,226	0	119,278

*The Yellowstone Recreation Emphasis Area is counted in this geographic area

Table 9 displays a range of objectives by alternative. The objectives for alternatives A, B, and C are based on the budget and accomplishments from 2014 through 2017. Alternatives D and E vary the objectives based on the theme of the alterative. In alternative E, the higher costs to accomplish the timber volume drive other objectives lower. The cumulative totals of all objectives in any alternative would be within the budgets from 2014 through 2017. Except where noted, partnership and external funds are not accounted for in the objectives.

Table 9. Objectives by alternative

Topic	Measure	Alternatives A, B, C	Alternative D	Alternative E
Streams	Miles restoration per decade	600	800	200
Lakes, Ponds, Wetlands	Acres restoration per decade	50	100	10
Aquatic Passage; Conversation Watershed Network priority	Number of projects installed per decade	5 to 7	7 to 10	1 to 3
Conversation Watershed Network roadway drainage erosion control enhancement	Road miles per year	5 to 8	5 to 8	5 to 8
At-risk aquatic species	Number of enhancement projects per decade	5 to 7	8 to 10	1 to 3
At-risk plants	Number of enhancement projects per decade	2	3	1
At Risk Wildlife	Number of enhancement projects per decade	3 to 7	8 to 10	1 to 2
Terrestrial Wildlife	Number of enhancement projects per decade	10	12	5
Bison	Number of enhancement projects every three years	1	3	0
Grizzly Bears	Number of potential relocation sites by 2022	5	7	3
Noxious weeds	Acres treated per year	2,500 to 4,500	4,500 to 7,000	500 to 2,500
Cultural Resources	Number of public outreach projects per year	10	5	5
Cultural Resources	Percent priority assets managed per year	20	25	20
Permitted Grazing	Animal Units Months (AUMs) per year	219,300	213,800	213,800
Projected Timber Sale Quantity (PTSQ) PTSQ does not include salvage harvest	Million board feet per year (mmbf) Million cubic feet per year (mmcf)	10 1.9	6 1.2	15 2.9
Projected Wood Sale Quantity (PWSQ)	Million board feet per year (mmbf) Million cubic feet per year (mmcf)	18 3.9	13 2.9	25 5.3
Projected Vegetation Treatment (fuels and timber)	Acres per year	6,000 to 7,500	8,000	5,000
Hazardous fuels	Acres treated per year	6,000	7,000	4,000
Natural unplanned wildfire	Acres per decade	375,000	375,000	375,000
Aspen, Whitebark, etc. Vegetation Treatment	Projects per decade Acres per decade	5 to 8 600 to 750	8 to 10 800	2 500
Roads - high clearance	Percent maintained per year	20	5	10 Priority timber access
Roads - passenger	Percent maintained per year	75	75	75

Topic	Measure	Alternatives A, B, C	Alternative D	Alternative E
Roads - removal	Miles removed per decade (40 miles left on national forest)	40	40	40
Trails	Percent maintained to standard per year	30	30	30 Priority front country
Trails	Percent maintained per year	80	30	30
Facilities (admin)	Percent maintained per year	60	40	40
Recreation Sites/Facilities in riparian management zone	Number removed per decade	5	7	2
Wilderness and recommended wilderness boundaries near adjacent motorized settings	Number boundary areas signed per decade	5	20	2
Existing travel incursions in P ROS	Number incursions eliminated per decade	5	5	2
Existing unauthorized motorized travel incursions in SPNM ROS	Number incursions eliminated per decade	5	0	5
Recreation Site Accessible Design in RN ROS	Number sites accessibility improved per decade	3	1	3
Designated Wilderness. Unneeded existing improvements, facilities or uses	Number removed per decade	3	3	3
Hyalite REA Day Use Access Sites	Number added per decade*	1	0	2
Hebgen Lakeshore REA Dispersed sites	Number converted to larger campgrounds per decade*	1	0	2
Road/Trail ROW	Number acquired per decade	1 to 5	1 to 5	1 to 5 Priority timber access

*Recreation emphasis area additional facilities depend on competitive Capital Improvement Project funds and external funds.

Chapter 3. Affected Environment and Environmental Consequences

3.1 Introduction

This chapter presents the existing environment of the Custer Gallatin National Forest plan revision area and the potential consequences to that environment that may be caused by implementing the alternatives described in chapter 2. Within each resource section, the boundaries of the area used for the resource analysis are disclosed. The discussions of resources and potential effects use existing information included in the Assessment of Existing Conditions, other planning documents, resource reports and related information, and other sources as indicated. Where things have changed since the assessment was published, updates have been included.

Numbers such as acres, miles, and volumes are approximate due to the use of geographic information system (GIS) data and rounding.

This is a programmatic document, disclosing affected environments and environmental consequences at a planning level scale; not at the site-specific project-level scale. Therefore, this document does not predict what would happen each time the proposed plan components are implemented. Land management plans do not have direct effects. They do not authorize or mandate any site-specific projects or activities (including ground-disturbing actions). However, there may be implications, or longer-term environmental consequences, of managing the national forests under this programmatic framework. As a result, all effects discussed in this section are considered indirect effects, unless otherwise noted. The environmental effects of those site-specific projects depend on the environmental conditions of each project site, the plan components applied, and implementation.

The affected environment is based in large part upon the Assessment of Existing Conditions, but includes updates and new information that have become available since its printing. The environmental consequences discussions in this chapter allow a reasonable prediction of consequences on the Custer Gallatin National Forest. However, this document does not describe every environmental process nor condition.

The 2012 Planning Rule requires the responsible official to use the best available scientific information to inform the development of the proposed plan, including plan components, the monitoring program, and plan decisions. The foundation from which the plan components were developed for the proposed action was provided by the Assessment of Existing Conditions, the best available scientific information, and analyses therein. From this foundation, specialists used a number of resources that included peer-reviewed and technical literature, databases and data management systems, modeling tools and approaches, local information, workshops and collaborations, and information received during public participation periods for related planning activities. Resource specialists considered what is most accurate, reliable, and relevant in their use of the best available scientific information. The best available scientific information includes the publications listed in the literature cited sections of the Assessment of Existing Conditions and draft environmental impact statement.

3.2 Air Quality

3.2.1 Introduction

The Forest Service is required to monitor and protect several resources on public lands, including air quality. Air quality is dependent on the type and amount of pollutants emitted into the atmosphere, the location and topography of an airshed, and the prevailing meteorological and weather conditions. Sources of air pollution within the Custer Gallatin National Forest include particulates and chemicals generated from timber and mining operations, wildland fire, road dust, transportation, and other combustion engines sources. Air pollution sources outside of the Custer Gallatin affecting the national forest include agricultural sources such as crop burning, municipal emissions, and other sources including long distance source emissions transmitted via continental airflow patterns.

The focus of this discussion is on smoke and how the various Custer Gallatin Forest Plan alternatives could affect smoke production through the use of wildland fire, natural (but unplanned) ignitions to meet resource objectives, and emissions from wildfires. Smoke from all activities is the greatest contributor to air quality and visibility. Of all potential sources of air pollution from management activities that occur on the Custer Gallatin (such as, road dust, mining operations, emissions from logging equipment and recreational vehicles), smoke is the most substantial contributor to air quality and visibility. Smoke can exacerbate public health issues as well as obscure visibility. However, there is a need to use fire to maintain and restore the fire-adapted ecosystems on the national forest and to reduce hazardous fuels in the wildland urban interface.

Regulatory Framework

Federal Clean Air Act: The 1970 Clean Air Act (www.epa.gov/air/caa/title1.html), as amended in 1977 and 1990 (42 U.S.C. 7401 et seq.) provides the foundation for protections of clean air on Federal lands. The 1977 Clean Air Act amendments direct Federal land managers to “preserve, protect, and enhance the air quality” in 156 mandatory class I national parks and wilderness areas (42 U.S.C. 7470 et seq.). Class I areas are wilderness areas that were designated before August 7, 1977, and larger than 5,000 acres and national parks greater than 6,000 acres. All other land managed by Federal land managers are designated class II. Under the Clean Air Act, Federal agencies (including the Forest Service) are held responsible to protect air quality related values in class I areas.

Prevention of Significant Deterioration: The Clean Air Act requires Federal land managers,“…to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, … and other areas of special national or regional natural, recreational, scenic, or historic value.” Prevention of significant deterioration addresses resource protection through the establishment of ceilings on additional amounts of air pollution over base-line levels in “clean” air areas, the protection of the air quality-related values of certain special areas, and additional protection for the visibility values of certain special areas.

National Ambient Air Quality Standards (40 CFR part 50): Under the Clean Air Act, national ambient air quality standards were established (40 CFR part 50). National ambient air quality standards identified six criteria pollutants and established standards for each that must be met by state and Federal agencies and private industry (table 10). Criteria pollutants include carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter (PM2.5 and PM10), and sulfur dioxide. Primary standards are designed to provide protection to public health. Secondary standards are intended to protect against damage to animals, crops, vegetation, and buildings and to limit reductions in visibility.

Conformity Determinations: The general conformity provisions of the Clean Air Act (section 176(c)) prohibits Federal agencies from taking action within a non-attainment area which causes or contributes to a new or existing violation of the standards or delays the attainment of a standard.

Regional Haze Rule (40 CFR Part 51): Haze is created when sunlight is either absorbed or scattered by air pollution particles. Environmental Protection Agency's (EPA) 1980 visibility rules (40 CFR 51.301-307) were developed to protect mandatory class I areas from human caused damages attributable to a single or small group of sources. In 1988, EPA and other agencies began monitoring visibility in class I areas.

The 1999 Regional Haze Rule (40 CFR 51.308-309) called for states to establish goals to improve visibility in 156 national parks and wilderness class I areas and to develop strategies for the long term to reduce the emissions of air pollutants that cause visibility impairment. The regional haze regulations apply to all states, and require states to demonstrate reasonable progress for improving visibility in each class I area over a 60-year period (to 2064), during which visibility should be returned to natural conditions.

The Interim Air Quality Policy on Wildland and Prescribed Fires (U.S. EPA 1998): On May 15, 1998, the Environmental Protection Agency (EPA) issued the Interim Air Quality Policy of Wildland and Prescribed Fire to address impacts to public health and welfare (EPA 1998). The goal of the policy is to allow fire to function in an ecological role in order to help maintain healthy ecosystems. In doing so, it must also while balance the need to protect public health and welfare from the impacts of fire-related air pollution emissions. The policy is interim because it does not yet address agricultural burning or regional haze (EPA 1998).

The Interim Air Quality Policy of Wildland and Prescribed Fire suggests air quality and visibility impact evaluations of fire activities on Federal lands should consider several different items during planning (EPA 1998). In a project-level environmental analysis document it is appropriate to consider and address, to an extent practical, a description of applicable regulations, plans, or policies, identification of sensitive areas (receptors), and the potential for smoke intrusions in those sensitive areas. Other important disclosure items include applicable smoke management techniques, participation in a basic smoke management program, and potential for emission reductions.

Ambient air quality and visibility monitoring (for class I areas) are typically done collaboratively with the states. Impacts to regional and sub-regional air are addressed operationally through coordinated smoke management programs. The Environmental Protection Agency urges states to develop, implement, and certify smoke management programs that meet the recommended requirements of the Interim Air Quality Policy of Wildland and Prescribed Fire. In accordance with the policy, Montana has implemented a certified smoke management program. This program is administered through the Montana/Idaho Airshed Group (www.smokemu.org). Member burners of the Montana or Idaho Airshed Group (including the Forest Service) submit burn requests to the Smoke Monitoring Unit, which coordinates and approves prescribed burning activities in a manner designed to meet ambient air quality standards.

The Wilderness Act (16 U.S.C. 1131-1136): The Wilderness Act of 1964 mandates that wilderness areas be preserved for wilderness character and manage, preserve, and protect natural wilderness conditions (16 U.S.C. 1131-1136).

The Wilderness Act requires wilderness areas (class I and II) to be administered “for the use of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness.” While class II wilderness areas are protected by the Wilderness Act, class I areas have additional protections under the Clean Air Act. The Wilderness Act does not protect wilderness study areas or research natural areas.

National Forest Management Act (16 U.S.C. 1600-1614): Under the National Forest Management Act of 1976, national forests and grasslands must create land management plans. The law states “National Forests are ecosystems and their management….requires awareness and consideration of the interrelationships among plants, animals, soil, water, air, and other environmental factors within such ecosystems” (16 U.S.C. 1600-1614).

National Environmental Policy Act (NEPA) (42 U.S.C. 4321-4346): The National Environmental Policy Act requires national forests and grasslands to examine the environmental consequences of major proposed Federal actions. The decision making process must incorporate public input (42 U.S.C. 4321-4346).

State Implementation Plans: Each state is required under the Clean Air Act to have an Environmental Protection Agency (EPA) approved state implementation plan (SIP) (section 110(a)(2)) which identifies a strategy to maintain or attain national ambient air quality standards (section 110(h)(1)). The Montana State Implementation Plan was approved by EPA and promulgated through the Montana Clean Air Act, and implementing regulations to provide specific guidance on maintenance of air quality, including restrictions on open burning (ARM 16.8.1300). Montana and South Dakota State Implementation Plans can be found at: https://www.epa.gov/air-quality-implementation-plans/approved-air-quality-implementation-plans-region-8. The Montana Department of Environmental Quality and the South Dakota Department of Environment and Natural Resources have the regulatory authority to implement and enforce air quality in Montana and South Dakota respectively, at a standard equal to or more strict than EPA Federal standards. Montana uses Federal and Montana Ambient Air Quality Standards. South Dakota’s uses national ambient air quality standards as their ambient air quality standards.

Montana Code Annotated (Title 75. Environmental Protection): The Clean Air Act of Montana, chapter 2 “Air Quality” provides state regulatory requirements and outlines intent, limitations, and powers associated to the regulatory agency within Montana.

Administrative Rules of Montana (ARM) (Title 17, Chapter 8, Subchapter 6): This rule covers the general provisions of open burning including definitions, restrictions on non-burnable material, and major/minor burner requirements.

Smoke Management: Smoke management plans have been developed for many states with the purpose to manage and control smoke from wildland fire and burns. The goal is to minimize smoke in populated areas, prevent public safety hazards, avoid violations of the national ambient air quality standards, and to avoid visibility impacts in class I areas.

In Montana, the Forest Service is considered a major open burner (any entity that emits more than 500 tons of carbon monoxide or 50 tons of any other regulated pollutant per calendar year), and conducts prescribed burning under the provisions of an annual open burning permit issued by Montana Department of Environmental Quality (http://deq.mt.gov/AirQuality/OpenBurn/2015/USDAForestService.pdf).

The Custer Gallatin National Forest is a member of the Montana/Idaho Airshed Group (www.smokemu.org). Any prescribed burning in Montana must follow the guidelines established in the Montana/Idaho Airshed Group's Operating Guide (http://smokemu.org/docs/2010%20Operations%20Guide.pdf). Planned permitted burns are submitted to the smoke monitoring unit in Missoula, Montana. For each burn planned, the type of burn, the number of acres to burn, location, and elevation of each site are provided to the smoke monitoring unit. The Montana or Idaho Airshed Group Smoke Program Coordinator uses the burn information, along with meteorological forecasts, to recommend burn restrictions for airsheds with planned burning. The smoke monitoring unit issues daily burn recommendations for airsheds, elevations, or impact zones on the Montana/Idaho Airshed Group Website.

The Custer Gallatin National Forest will also comply with open burning guidelines of South Dakota's Department of Environment and Natural Resources (34A-1-18). The guidelines for open burning in South Dakota can be found at: http://denr.sd.gov/des/aq/openburn.aspx.

Key Indicators and Measures

Key indicators are ambient air quality and visibility, measured by projected acres of wildland fire. On the Custer Gallatin, smoke provides much greater air quality impacts that other management related actions such as recreation, grazing, agricultural burning, industrial emissions, mining and oil and gas development, residential sources, construction equipment, vehicles, road dust, gravel pit dust, and campground wood fires.

Methodology and Analysis Process

A qualitative assessment of smoke emissions from prescribed burning and wildfire was used in lieu of quantifying smoke emissions since the locations and timing of emission sources are not defined specifically in the forest plan alternatives. Wildfire emissions depend on site-specific vegetation and fuels conditions, ignitions, weather, and suppression resources and are much too variable to predict quantitatively. Therefore, the acres of prescribed burns and average estimated wildfires acres on the Custer Gallatin Forest were used to compare the air quality effect of alternatives. Modeling techniques (SIMPPLLE and PRISM) and estimated prescribed burn and wildfire acreage by plan alternatives are described in the Terrestrial Vegetation, Fire and Fuels, and Appendix B sections of this draft forest plan.

Information Sources

This assessment is based on the best available scientific information including peer-reviewed journal articles, Forest Service publications, state (Montana and South Dakota) and Federal statutes, laws, and regulations, and personal communication with air quality specialists. Best available scientific information used is cited throughout the assessment and included in the "Literature Cited" section.

Journal articles used have undergone a peer-review process from the scientific community as well as scrutiny from air quality specialists. The United States Forest Service is not a regulatory agency and must abide by the laws and regulations set forth by Federal (Environmental Protection Agency) and State (Montana Department of Environmental Quality and South Dakota Department of Environment and Natural Resources). Forest Service publications include direction on smoke management.

Analysis Area

Air quality is affected by emissions sources and pollutants, as well as weather patterns, terrain, and prevailing winds. All of these factors develop an area or region of consequential air quality. Primary pollutants are emitted directly. Secondary pollutants are formed through chemical reactions in the atmosphere from precursor pollutants. The region of influence for a primary pollutant depends on the rate of emissions from a source, the elevation of the source, the type of pollutant, and the meteorological conditions that determine dispersion and dilution during transport from the emissions source. The region of influence for primary pollutants (an area potentially subject to measureable air quality impacts under unfavorable dispersion conditions) is generally a relatively small area, ranging from 1 mile to less than a few miles from the source. The region of influence for a secondary pollutant, such as ozone, is much larger because secondary pollutants can impact air quality for well over 100 miles.

The analysis area for the evaluation of effects to air quality from forest plan alternatives includes the airsheds in which the Custer Gallatin National Forest is located. An airshed is a geographical area with similar atmospheric characteristics, such as wind patterns. Airshed boundary descriptions are detailed in the Montana/Idaho Airshed Group Operations Guide (MTDEQ 2010). The Custer Gallatin National Forest is within airsheds 8A, 8B (primarily Gallatin), and 10 (primarily Custer) (figure 2). The Montana Department of Environmental Quality (DEQ) and the Montana/Idaho Airshed Group Operations Guide established the Big Sky Smoke Impact Zone within airshed 8A due to potential inversions during prescribed burning projects. Proximity to the impact zone must be considered when burn plans are submitted for review and approval. The state of South Dakota does not have guidelines specific to burning on National Forest System land and the state has not designated airsheds.

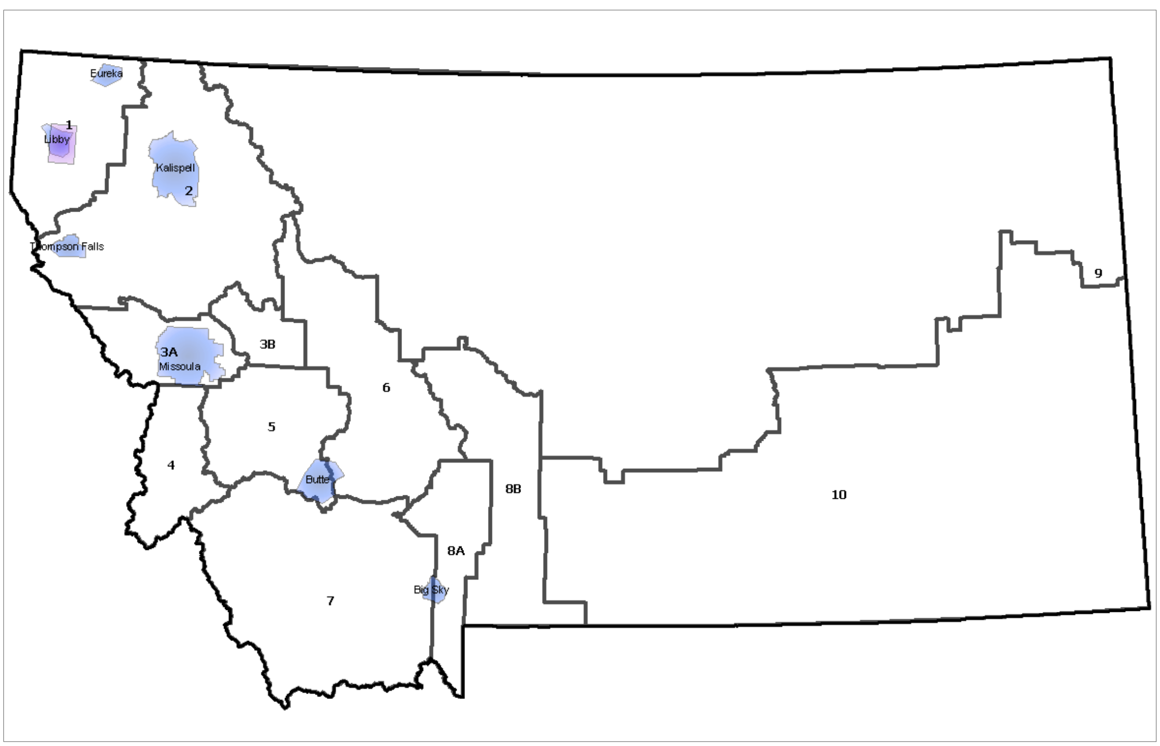

Figure 2. Montana airsheds

Because air flows freely across jurisdictional boundaries and pollutant sources include local and long distance sources covering vast landscapes, the analysis discusses air quality across the entire Custer Gallatin National Forest. The temporal scope of the analysis is the anticipated life of the plan.

3.2.2 Affected Environment (Existing Condition)

Emission Inventories

The Environmental Protection Agency (EPA) requires each state and local air agencies to report emissions of criteria pollutants and their precursors to the National Emission Inventory database. The National Emission Inventory is prepared and released online every 3 years. The latest available data at the time of this report in table 10 was for 2014.[1] These numbers represent the inventory of all pollution sources located in counties in and surrounding the Custer Gallatin National Forest and include emissions from man-made source of pollution. The primary source of emission on the national forest is occurrences, in the short term, of PM 10 and 2.5 due to fires, both wildland and prescribed. However, all human caused pollutants are transported into the Custer Gallatin have an effect on the overall environment.

The National Emission Inventory for 2017 is not available at the time of this report as it is scheduled to be available on 7/1/2019 and non-point source inventory data 12/1/2019.[2]

Table 10. 2014 National Emission Inventory for criteria pollutants by counties in Montana and South Dakota that contain part of the Custer Gallatin National Forest (emissions are in tons/year)*

County	PM_{10}	$PM_{2.5}$	SO_2	CO	NO_x
Carbon	7,818.53	1,170.80	33.17	6,891.65	1,279.64
Carter	8,167.27	1,739.87	17.23	7,580.73	1,198.37
Gallatin	26,140.57	3,773.88	479.59	25,249.91	4,871.40
Madison	7,250.96	1,165.49	23.12	8,090.87	1,350.21
Meagher	2,471.93	640.37	32.31	7,276.20	757.17
Park	6,496.83	1,028.13	61.10	8,618.64	1,834.14
Powder River	4,006.48	1,293.06	62.63	15,053.71	1,317.45
Rosebud	18,934.39	5,743.65	11,439.30	31,120.25	20,204.63
Stillwater	7,777.00	1,184.97	103.60	6,552.46	2,062.28
Sweet Grass	3,089.40	491.90	20.14	4,933.25	1,649.50
Harding (South Dakota)	6,547.46	1,302.87	12.97	4,034.79	1,557.80

*NEI emissions are subject to change—these emissions reflect NEI estimates web accessed January 29, 2017

In general, the predominant winds in south central Montana come from the west and southwest. The Custer Gallatin National Forest has complex mountainous and valley terrain, which can affect local wind patterns. In general the Custer Gallatin National Forest has robust wind dispersion with consistent up valley daytime breezes and down valley night drainage. Some valley inversions can reduce emission dispersion, particularly in the west fork of the Gallatin River including the Big Sky area. Regional air

[1] https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-data
[2] https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-plan

pressure patterns significantly affect air quality with robust dispersion during frontal storms, but accelerating fire spread during active wildfire events. Wind patterns and climate in South Dakota is summarized by the National Oceanic and Atmospheric Administration (Frankson et al. 2017).

Sensitive Air Quality Areas

Class I wilderness areas are managed in accordance with the Clean Air Act and Wilderness Act. Non-wilderness Class II areas are managed consistent with the Clean Air Act. Federal land managers, however, still have an obligation to protect air quality in Class II wilderness areas. Non-wilderness class II areas are managed according to multiple use objectives (such as habitat protection, recreation, and forest products) in accordance with forest management plans.

There are no class I areas managed by the Custer Gallatin National Forest. However, Yellowstone National Park and the Northern Cheyenne Reservation are both class I areas in close proximity to the Custer Gallatin Forest. The Lee Metcalf Wilderness and the Absaroka-Beartooth Wilderness are both class II wilderness areas and sensitive air quality areas, but do not have additional specific air quality regulatory protection by the Wilderness Act. The Hyalite/Porcupine-Buffalo Horn Wilderness Study Area is also considered a sensitive air quality area.

The Montana/Idaho Airshed Group designated the Big Sky Smoke Impact Zone on the Custer Gallatin, which is in airshed 8A. Proximity to the impact zone and potential emission effects are considered by the airshed group before issuing burn permits.

Nonattainment Areas

National Forest land that falls within nonattainment areas are subject to Conformity Determinations of the Clean Air Act (section 176(c)); meaning every Forest Service action that produces non-mobile air pollutants must be evaluated for its effect on the nonattainment area.

The entire state of South Dakota is in attainment. No portion of the Custer Gallatin National Forest lies within a nonattainment area; however, there are a few nonattainment areas in close proximity (as of October 1, 2015[3]). Lame Deer in Rosebud County is in marginal nonattainment for PM10. Billings and the greater Laurel area in Yellowstone County are both in nonattainment for sulfur dioxide.

Monitoring Programs

Air quality monitoring in and around the Custer Gallatin National Forest is conducted by national, state, and local programs that inform the Custer Gallatin of trends and changes in air quality around the national forest. The two primary national monitoring programs are Interagency Monitoring of Protected Visual Environments (IMPROVE) and National Atmospheric Deposition Program (NADP). The Environmental Protection agency (EPA) mandates each state to establish a network of monitors that measure ambient air concentrations of criteria pollutants (40 CFR Part 58). This monitoring network is known as State and Local Air Monitoring Stations (SLAMs). States also have special purpose monitors (SPMs) that are not part of the SLAMs network. The Custer Gallatin National Forest uses IMPROVE and NADP data to assess air quality conditions on National Forest System lands. Visibility measured by IMPROVE and precipitation chemistry measured by NADP are part of the air quality-related values monitored across the Custer Gallatin to keep track of overall air quality (table 11). Other air quality-related values measured directly by the Forest Service are lichens and lake water chemistry. The Custer

[3] https://www3.epa.gov/airquality/greenbook/

Gallatin National Forest works as a cooperator with the United States Geological Survey to help sample snowpack chemistry each year at selected sites. The Custer Gallatin National Forest intermittently partners with universities and researchers to gain and expand knowledge about air pollution.

Table 11. Wilderness areas, class rating, air quality-related values that are monitored, and laws

Wilderness	Air Quality-Related Values	Laws
Absaroka-Beartooth (Class II)	Long-term lake water chemistry, lichens, visibility, snowpack chemistry	Wilderness Act
Lee Metcalf (Class II)	Lichens, snowpack chemistry, synoptic lake sampling	Wilderness Act
Porcupine-Buffalo Horn Wilderness Study Area (Class II)	Lichens	National Forest Management Act
Yellowstone National Park (Class I)	Visibility, NADP precipitation chemistry, snowpack chemistry, climate	Clean Air Act NPS 1916 Organic Act
Northern Cheyenne Reservations (Class I)	Visibility	Clean Air Act

The IMPROVE Program

The Interagency Monitoring of Protected Visual Environments (IMPROVE) is a national program that started in 1985 to establish baseline conditions and monitor visibility in 156 class I areas as mandated from the 1977 amendments to the Clean Air Act. IMPROVE monitoring also serves as a marker to assess progress toward the national visibility goal of no manmade impairment in support of the Regional Haze Rule. IMPROVE monitors sample ambient air with samples collected every Tuesday throughout the calendar year.[4]

The Interagency Monitoring of Protected Visual Environments (IMPROVE) network includes two monitors in the vicinity of the Custer Gallatin National Forest. One is in Yellowstone National Park (YELL2). The original site established in 1988 was known as YELL1, but was moved a mile to its current site (YELL2) near Yellowstone Lake in 1996 due to problems with dust. The second monitor is the North Absaroka monitor (NOAB1) on top of Dead Indian Pass, northwest of Cody, Wyoming. Grenon et al. (2010) found an increase in visibility (visual range) from 1988 to 2007 at YELL2 IMPROVE site due to annual decreasing trends in elemental carbon, fine soil, and coarse mass. No annual or seasonal trends were found with ammonium sulfate and ammonium nitrate (Grenon et al. 2010). Plotting the 20 percent most impaired (highest fraction of haze) days of human caused sources (excluding natural sources such as wildland fires) and re an increase in visibility at both the NOAB1 and YELL 2 IMPROVE sites between 2004 and 2014.

National Atmospheric Deposition Program

The National Atmospheric Deposition Program (NADP) started in 1978 with the primary purpose to monitor acidity levels in precipitation. The program measures precipitation chemistry (both rain and snow) and total precipitation at numerous sites across the country. Samples are collected every Tuesday throughout the calendar year.[5]

Two National Atmospheric Deposition Program (NADP) sites relevant to the Custer Gallatin National Forest; Tower Falls (WY08) in Yellowstone National Park and Little Bighorn (MT00) at the Little Bighorn

[4] More information about the IMPROVE program including data can be found at http://vista.cira.colostate.edu/improve/.
[5] Data and sampling protocols can be found at http://nadp.isws.illinois.edu/.

Battlefield National Monument, Montana. WY08 was started in 1980 and MT00 was started in 1984. Analyzed NADP data between start dates and 2006 found annual ammonium concentrations in precipitation had increased significantly while sulfate concentrations had decreased significantly at both the MT00 and WY08 sites. Nitrate concentrations had increased at the WY08 site (Grenon and Story 2009). These trends of increasing ammonium and decreasing sulfate concentrations have been widely documented over much of the western United States.

State Monitoring

In Montana, the Department of Environmental Quality has four monitors within the Custer Gallatin National Forest. These monitors are located in Billings, Broadus, Birney, and West Yellowstone. The monitors measure ambient concentrations of ozone (O3), carbon monoxide (CO), nitrogen dioxide (NO2), sulfur dioxide (SO2), and particulate matter of 10 microns (PM10) and 2.5 microns (PM2.5) (table 10). In South Dakota, no state air quality monitors are located in Harding County or near the Custer Gallatin National Forest.

Additional information about Montana's and South Dakota's monitoring programs can be found in the Montana Ambient Air Monitoring Program Quality Management Plan (2017) and the South Dakota's Ambient Air Monitoring Annual Plan (2015).[6]

Long-term Lake Chemistry

The Forest Service Northern Region Air Monitoring Program samples sensitive lakes in high alpine wilderness areas to monitor trends in lake chemistry. Many high alpine lakes are sensitive to deposition of air pollutants because the lake water chemistry is so weak. Two lakes sampled by the air program, Stepping Stone and Twin Island, are located in the Absaroka-Beartooth Wilderness on the Custer Gallatin National Forest. Lake sampling in the long term for this wilderness started in 1993. Both lakes are sampled once annually in the deepest part via raft (Story 2007).

In 2009, chemistry in both lakes was analyzed for trends (1993 to 2007) in acid neutralizing capacity, ammonium, nitrate, sulfate, calcium, chloride, and pH (Grenon and Story 2009). Stepping Stone showed a decreasing trend in acid neutralizing capacity and chloride while pH showed an increasing trend at both lakes (Grenon and Story 2009). Trend analysis was rerun because a change in laboratories used for analyzing lake chemistry was not accounted for in the original analysis and could have skewed the results. Trends in acid neutralizing capacity have been rerun for Stepping Stone and Twin Island (1993 to 2011) with no trends detected (McMurray 2017).

United States Geological Survey Snowpack Surveys

In 1993, the United States Geological Survey (USGS) initiated snow sampling across the Rocky Mountains with the purpose of measuring total winter atmospheric pollution in snowpack. The program grew to 57 sites throughout the Rocky Mountains with 14 sites in the Greater Yellowstone Area, including sites on the Custer Gallatin. At each site, a bulk sample of the entire snowpack is collected once per year and the snow sample is then analyzed for pollutants (nitrogen, sulfur, mercury) and major ions.[7]

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[6] https://deq.mt.gov/Portals/112/Air/AirMonitoring/Documents/2016_NETWORK_PLAN_FINAL.pdf
https://denr.sd.gov/des/aq/aqnews/Annual%20plan%202015%20Final.pdf

[7] Data and more information about the USGS Rocky Mountain Regional Snowpack Chemistry Monitoring Study Area can be found at http://co.water.usgs.gov/projects/RM_snowpack/.

Three snowpack sites are located on the Custer Gallatin National Forest in Montana: Lion's Head outside of West Yellowstone, Big Sky Ski Resort, and Daisy Pass outside of Cooke City. Three snowpack sites are located in Yellowstone National Park including Canyon, Sylvian Lake, and Lewis Lake Divide.

Snowpack sites in the Greater Yellowstone Area have trends similar to much of the western United States, showing an increase in trends in ammonium with mean concentrations higher than the regional median. The highest concentrations were on the west side of the Greater Yellowstone Area. Snowpack sites had decreasing trends in nitrate and sulfate with mean concentrations lower than the regional median.

Critical Loads

In order to protect sensitive ecosystem components, critical loads have and are being developed (Pardo et al. 2011). A critical load quantifies atmospheric deposition loading (usually in kg ha-1 year-1), attaching a number to different ecosystem components, below which no harmful effect will occur (Spranger et al. 2004)(UBS 2004). The development of critical loads helps inform managers when making decisions. For example, exceedance of critical loads for nitrogen deposition has been linked to ecosystem eutrophication (excess nutrients) or acidification (increase in carbon dioxide) depending on ecosystem characteristics and the level, duration, and type of nitrogen deposition (Fenn et al. 2003, Bobbink et al. 2010, Baron et al. 2011, Benedict et al. 2013). Eutrophication can lead to stimulation of plant and algal growth, and increased competition within biotic communities; favoring invasive species and decreasing occurrence of sensitive species (Baron 2006, Howarth 2008, Beem et al. 2010, Benedict et al. 2013). The critical load for nitrogen deposition varies among different ecosystem components (Pardo et al. 2011). Federal land managers can choose to manage for differing levels of nitrogen loading based on the critical loads for various ecosystem components.

Nearly all the work done on critical loads in the northern Rocky Mountains has focused on nitrogen deposition. Critical loads range from 1.4 kg wet nitrogen ha-1 year-1 for diatoms in sensitive high alpine lakes (Saros et al. 2011) while wet + dry nitrogen deposition above 4.0 kg ha-1 year-1 has been associated with episodic freshwater acidification, lichen degradation, and changes in mineralization, nitrification, and soil chemistry of subalpine forests (Baron et al. 1994, Williams and Tonnessen 2000, Rueth and Baron 2002, Fenn et al. 2003, Baron et al. 2011, Saros et al. 2011).

Background (pre-industrial) nitrogen deposition in the northern Rocky Mountains forested ecosystems is estimated at < 1 Kg N ha-1 year-1 (Holland et al. 1999, Sverdrup et al. 2012). Current total nitrogen (wet + dry) deposition levels in this area are estimated to be between 0.5 to 8 kg nitrogen ha-1 year-1 (Burns 2003, Grenon et al. 2010, U.S. Department of the Interior 2011, Nanus et al. 2017), meaning some areas in the northern Rocky Mountains are exceeding critical loads for nitrogen deposition.

Epiphytic Lichens

Lichens have been collected on the Custer Gallatin National Forest to assess trends, hotspots of deposition, and to help inform critical load estimates. Epiphytic lichens are good indicators of current air quality conditions because they receive nutrients primarily from the atmosphere, lack regulatory structures such as stomata and a cuticle, and are sensitive to acidifying and fertilizing pollutants (Munzi et al. 2010).

The Northern Region Air Program collects epiphytic lichens from established plots every 5 to 8 years. New plots are continuously added to fill spatial and informational gaps. Lichen collection and laboratory protocols follow (Geiser 2004). There are no lichen plots east of the Beartooth Mountain Range on the Custer Gallatin National Forest.

Lichen analysis has estimated that nitrogen deposition on parts of the Custer Gallatin National Forest are twice the estimated background amounts (less than 1 Kg nitrogen ha-1 year-1) (Holland et al. 1999, Sverdrup et al. 2012), but lower than maximum critical loads for lichens (less than 4.0 Kg nitrogen ha-1 year-1) (McMurray et al. 2015). These hotspots occur at lower elevations around Bozeman, Montana, and may be due in part to localized sources and common inversions. More work is needed to refine critical loads for lichens in the northern Rocky Mountains as 4.0 Kg nitrogen ha-1 year-1 is likely too high and not sufficiently protective of lichen communities (McMurray et al. 2015). No critical loads for sulfur deposition have been identified for lichens in the northern Rocky Mountains.

Atmospheric Deposition of Nitrogen and Sulfur in the Greater Yellowstone Area.

Nanus (2016) developed annual deposition maps and critical loads estimates in the Greater Yellowstone Area for nitrate, ammonium, and dissolved inorganic nitrogen wet deposition (at 400-meter scale). Critical Load estimates of nitrogen deposition and exceedances of critical loads for inorganic and total nitrogen deposition (wet + dry) were also mapped.

Hot spots for ammonium and total nitrogen deposition exist on the Custer Gallatin National Forest mainly in high elevations around West Yellowstone (Southern Gallatin Range) and the Beartooth Plateau. Critical total nitrogen load estimates for surface waters on the Custer Gallatin National Forest ranged from less than 1.5 to more than 10.0 kg ha-1 year-1. The variation in range reflects differences in elevation, precipitation, and vegetation. High alpine zones have little buffering capacity due to sparse vegetation and shallow soils. High elevation sites have the most critical load exceedances since they are most sensitive areas to small increments of nitrogen loading. Parts of the Custer Gallatin National Forest, primarily on the Beartooth Plateau, are estimated to be at critical load exceedance for surface waters but ground-truthing of the Nanus maps is needed. Lakes on the Beartooth Plateau that are fed by glacier melt water maybe at even more risk to nitrogen critical load exceedances as glacier melt water has been found to influence nitrate concentration in streams (Saros et al. 2010, Vandeberg and VanLooy 2016). No trends in nitrogen chemistry have been documented in the two long-term lakes monitored by the Northern Region Air Program (Grenon and Story 2009).

3.2.3 Environmental Consequences

All Alternatives

Management Direction under the Current Plans

Gallatin Forest Plan forestwide standard 9 requires that the Custer Gallatin will cooperate with the Montana Department of Environmental Quality in the state implementation plan and smoke management plan. The Custer Forest Plan goal of air resource management is to meet or exceed State air quality standards and ensure protection of air quality related values. Custer Forest Plan standards require cooperation and coordination with states, other agencies, and organizations in identifying, evaluating, proposing solutions, reducing impacts, and monitoring air quality problems associated with activities permitted on national forests and grasslands.

Custer Forest Plan fuels standards require that a combination of treatments will be used that will most efficiently meet the fuels management direction of each management area; this incudes, the use of wildland fire (using both planned and unplanned ignition) as a management tool. A forestwide Gallatin Forest Plan standard provides that one or more fire management strategies may be considered and implemented for any unplanned wildland fire to achieve a variety of resource management objectives, while minimizing negative effects to life, investments, and valuable resources.

Management Direction under all Revised Plan Alternatives

Similar to the current plans, a goal of the revised plan alternatives would be cooperation with Federal, State, and/or tribal agencies to meet air quality regulations, and to coordinate prescribed burns with appropriate partners to minimize smoke impacts. Further, the revised plan envisions positive air quality contributions to multiple human and ecosystem values.

Effects Common to all Alternatives

The Custer Gallatin National Forest and adjacent communities generally have good air quality as detailed in the affected environment section of this plan. Municipalities in winter, December and January, can have elevated PM2.5 concentrations due to localized inversions, which can reduce atmospheric mixing of pollution sources. July, August, and September are likely to register increases the highest overall PM2.5 concentrations due to wildland fires, agricultural burning, and agriculture dust. Much of the Custer Gallatin National Forest is sparsely populated and subject to transport winds that disperse pollutant emissions. However, calm high-pressure systems common in the summer can reduce dispersion. Smoke from agricultural, personal debris burning, prescribed burning, or wildfires can settle for days, concentrating pollutants in valley bottoms. Fine particulates associated with smoke from wildland fires can be especially problematic for ongoing health problems and for the elderly and children (EPA 2003). The Montana Department of Environmental Quality and counties regulate open burning throughout the year while working with the Montana/Idaho Airshed Group to coordinate projects and potential air quality impacts from each prescribed burn.

Air quality impacts from wildfires may intensify in the future with greater frequency and larger amounts of burned acres. Climate projection scenarios anticipate increased temperatures on the Custer Gallatin (Halofsky et al. 2018b;c), which would likely lengthen wildfire seasons. The window for available burning by wildfires may broaden which would affect fire frequency in mid to upper elevation areas where fuel moisture and burning conditions during summer months currently inhibit fire spread. Spracklen et al. (2009) indicate that increases in emissions from wildfires may increase organic carbon concentrations by 40 percent and elemental carbon concentrations by 20 percent over the western United States by 2050. Large fires are expected to continue to occur on the Custer Gallatin Forest, driven by climate, weather, and fuel conditions, including the influence of the Pacific and Atlantic climate cycles which affect winds and sea surface temperatures (Decadal Oscillation, El Niño Southern Oscillation, and the Atlantic Multidecadal Oscillation (Kitzberger et al. 2007).

National direction for Forest Service management actions would continue to affect how wildfires and fuels are managed across the Custer Gallatin. Variable fire budgets would affect suppression efforts, wildland fire implementation, hazardous fuels planning, and wildland fire implementation. National direction will also continue to provide forests with guidance in the management of wildland fires and fuels on the landscape. National direction would likely continue to focus on increasing the occurrence of fires managed for restoration, resiliency and resource benefit objectives; hazardous fuels reduction; and accelerated restoration and resiliency objectives.

Climate change for each alternative would affect smoke emissions. Decreasing snowpack, earlier springtime conditions and snow melt, and longer, warmer fire seasons would increase the frequency and area burned by wildfires.

Effects Common to the Revised Plan Alternatives

The primary air quality emission variable from the plan revision alternatives is smoke from wildfires. Wildfire smoke, and to a lesser degree, prescribed burning smoke, is anticipated to be the primary source of emissions and associated impacts to air quality on the Custer Gallatin National Forest, as it has been historically. The Forest Service has limited ability to alter or control the location or extent of wildfires due to their unpredictable nature. Wildfires from local and long-range sources have potential to influence short-term air quality and visibility, but the SIMPPLLE and PRISM model results indicate that wildfire acreage potential does not vary between alternatives.

Table 12 displays estimated acres of wildland fire for all revised plan alternatives based on modeled future projections using the PRISM model. These estimates are derived from a modeling analysis explained in the terrestrial vegetation and fire and fuels sections, and Appendix B. The SIMPPLLE and PRISM model analysis shows that the potential differences in estimated wildfire acres per decade (averaged over five decades) in forested areas between alternatives are too small between alternatives to show a difference. Estimated 10-year wildfire acreages for each alternative are 250,000 forested acres.

Table 12. Projected SIMPPLLE and PRISM model average acres per decade of wildfire and prescribed fire by each alternative (averaged over five decades)

Component and Indicator	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Wildfire (USFS): forested acres burned	250,000	250,000	250,000	250,000	250,000
Forested Areas Prescribed Fire (USFS): acres burned[1]	27,645	28,093	28,093	38,011	24,085

1. Acres are from the SIMPPLLE and PRISM models and only include forested areas. Non-forested area is not included in these figures, but do include areas both inside and outside the wildland urban interface.

Note: Alternative A represents the current plans' future projections if kept

The Custer Gallatin will continue to adhere to the current state smoke management plans, the Montana/Idaho Airshed Group and open burning guidelines of South Dakota’s Department of Environment and Natural Resources (34A-1-18). The Custer Gallatin staff will obtain required permits and approval from the Montana Department of Environmental Quality (MTDEQ) and South Dakota Department of Environment and Natural Resources (DENR) to conduct prescribed burning operations and implementation of wildfires used for resource benefit. These controls are managed to provide for protection of public health and welfare by mitigating the impacts of air pollution, while still allowing fire to be used in maintaining healthy ecosystems, reducing catastrophic wildfire, and protecting property.

Effects of the Current Plans

Current plan direction is to coordinate all Forest Service management activities to meet the requirements of the State implementation plans and State smoke management plan (Montana/Idaho Airshed Group (MDEQ 2010), South Dakota Department of Environment and Natural Resources requirements, and Federal and State air quality standards.

Projected vegetative treatments include primarily prescribed burning and thinning. The acres per decade of wildland fire were estimated to be 27,645 acres for the current plans. Wildland fire must operate under constraints established by the Montana/Idaho Airshed Group and South Dakota Department of Environment and Natural Resources. Air quality is to be maintained at adequate levels as described by State, county, and Federal direction, and all prescribed burns conducted on the Custer Gallatin will be governed by this direction and meet this intention.

Under the current plans, short and long-term effects to air quality would continue under current management of wildland fire. Continued use of wildland fire has the potential to influence air quality and visibility in local areas in the short term. The current management direction requires meeting air quality standards established by Federal and state agencies through requirements of state implementation plans and smoke management plans. The Custer Gallatin must meet air quality standards established by the Environmental Protection Agency and Montana Department of Environmental Quality through requirements of state implementation plans (concerning National Ambient Air Quality Standards) and the State smoke management plan. Use of wildland fire under all alternatives would be restricted by how much vegetation, (for example, fuel loading/acre, acres that can be burned per day), when and where burns can occur, and budget constraints. These constraints limit the use of wildland fire and affect the rate of emissions and volume of smoke and particulates, which in turn limits impacts to human health and visibility.

Effects of Alternatives B and C

Alternatives B and C objectives reflect a mix of resource enhancement with timber production on suitable lands. Projected timber harvest and wildfire acres for alternatives B and C (28,093 acres) are similar to the current plans. Estimated emissions and cumulative effects for Alternatives B and C are similar to the current plans.

Effects of Alternative D

Alternative D emphasizes resource enhancement, moving towards forested vegetative desired conditions and wilderness character. This alternative maximizes recommended wilderness areas (RWAs), but deemphasizes timber and wood products volume, road and trail maintenance, and new recreation facilities. Projected vegetative treatments include primarily prescribed burning and thinning. The acres per decade of wildland fire were estimated to be 38,011 acres. This would likely result in higher wildland fire emissions than the current plans and alternatives B, and C associated with more acres of wildland fire in alternative D.

Effects of Alternative E

Alternative E emphasizes higher human presence and use of the Custer Gallatin National Forest with greater timber and wood products volume. Alternative E has lower objectives for hazardous fuels treatment, with less emphasis on moving toward wilderness character, resource enhancement, and road maintenance. Alternative E would offer more motorized and mechanized recreation opportunities and not include any recommended wilderness areas. Projected vegetative treatments include primarily prescribed burning and thinning. The acres per decade of wildland fire were estimated to be 24,085 acres for alternative E, which is the lowest amount of wildland fire of all alternatives since more of the timber volume would be included in wood sales. Overall, wildland fire emissions would likely be lower than the current plans and alternatives B, C and D due to fewer acres of prescribed burning.

Consequences to Air Quality from Forest Plan Components Associated with other Resource Programs or Management Activities

Other management activities, such as dust from roads, mining, pollution from recreational and administrative vehicles, recreation activities, methane emissions from grazing, timber harvesting, are not expected to significantly affect air quality compared to the much larger smoke emissions from wildfire and prescribed burning smoke as discussed in the affected environment section.

Cumulative Effects

Most impacts to air and visual quality in the Custer Gallatin National Forest are related to the contribution of smoke from areas south and west of the national forest which can result in decreases in air quality and visibility. Smoke from Canadian wildfires, as occurred from British Columbia and Alberta in 2017, can also contribute to decreased air quality on the national forest.

Portions of the Custer Gallatin adjoin other national forests, each having its own forest plan. Management of vegetation is generally similar across all national forests due to law, regulation, and policy. In addition, the Custer Gallatin is intermixed with lands of other ownerships, including private lands, other Federal lands, and State lands.

In addition to emissions from wildfire and prescribed burning on the Custer Gallatin National Forest, air quality would be affected by other emissions on the national forest, surrounding and upwind regional area sources including, but not limited to wildfire and prescribed burning, agricultural burning, industrial emissions, mining and oil and gas development sources, residential and municipal sources, construction equipment, vehicles, road dust, gravel pit dust, and campground wood fires, and smoke from non-national forest wildland fires. Long distance regional sources can occur from the Western United States and even Canada and Asia.

Conclusion

The air quality in and around the Custer Gallatin is generally good with limited amounts of industrial, residential, agricultural, and transportation source emissions. The primary alternative variable that affects air quality in the Custer Gallatin National Forest is smoke and particulate matter from wildfires (with most of the wildfire smoke impacts occurring in the July through September period). The revised plan alternatives vary slightly in smoke production due to the amounts of wildland fire use. Variability in wildfire smoke on the Custer Gallatin is largely a function of weather and location of fire ignition sites and beyond the direct control of forest plan alternatives. In general, for the Custer Gallatin, wildland fire smoke particle emissions on a per acre basis for wildfire are about four times the smoke emissions from wildland fire, since wildfires usually occur in warmer and dryer conditions that wildland fire. However, due to the non-site specific nature of the revised plan alternatives, smoke/particulate quantification poses too many variables to be credibly quantified. In all alternative, climate change is anticipated to increase the frequency of large wildfires and increased smoke impacts.

The revised plan alternatives incorporate legal and policy direction designed to enhance and maintain ecosystem resiliency and sustainability, and protect values at risk of damage from wildfires. The Custer Gallatin would continue to adhere to the Montana smoke management plan, and obtain required permits and approval in order to conduct prescribed burning operations and implementation of wildfires used for resource benefit purposes.

The revised plan alternatives would meet the purpose and need because the use of wildland fires used for management for resource benefit would improve ecosystem sustainability and resiliency, and protect values at risk from damaging wildfires, while meeting air quality requirements mandated by the Clean Air Act. Adverse effects of increased smoke emissions would be mitigated by the Custer Gallatin's compliance with the legal frameworks that regulate air pollution sources in the states of Montana and South Dakota.

3.3 Soils

3.3.1 Introduction

In natural systems, soil resources along with local climate and topography are primary determinants of the land's inherent ability to grow specific types and amounts of native vegetation. As a result, nearly all goods and services provided to the public on National Forest lands are in one way or another dependent on soil productivity. Maintaining that productivity is essential to preserving the Custer Gallatin's ability to provide resource benefits to the public. These benefits include, but are not limited to, clean water, wildlife habitat, fisheries, timber and grazing resources, recreation opportunities, and pristine landscapes.

The people of the United States benefit from all the above listed amenities as well as others not listed. Without soil resource, there would be little or no terrestrial vegetation present on the landscape, nor would most of the amenities currently enjoyed by the public on Forest Service lands exist (or would exist in a degraded state). The reasons why National Forest lands were set aside would no longer exist if not for a healthy, productive, soil resource.

Regulatory Framework

The Multiple-Use, Sustained-Yield Act of 1960 (P.L. 86-517, 74 Stat. 215: 16 S.S.C. 528-531): indicates that a high-level of annual or regular periodic output of renewable resources will be produced and specifies "…coordinated management of resources without impairment of the productivity of the land."

Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 (16 U.S.C. 1600-1614) and the National Forest Management Act (NFMA) of 1976 (16 U.S.C. 472a): states "…substantial and permanent impairment of productivity must be avoided."

Forest Service Manual Chapter 2550 - Soil Management (WO Amendment 2500-2009-1): refers to "providing goods and services as outlined in forest and grassland management plans."

Forest Service Manual, Chapter 2550 – Soil Management 2009 and 2010 amendments: directs the Washington Office Director of Watershed, Fish, Wildlife, Air, and Rare plants to "coordinate validation studies of soil quality criteria and indicators with Forest Service Research and Development staff to ensure soil quality measurements are appropriate to protect soil productivity" (USFS-FSM 2009). Six different "soil functions are described: soil biology, soil hydrology, nutrient cycling, carbon storage, soil stability and support, and the capacity to filter and buffer environmental contaminants. All of these, with the possible exception of carbon storage, relate directly to primary soil productivity.

Forest Service Northern Region Supplement 2550-99-1: directs land managers to "design new activities that do not create detrimental soil conditions on more than 15 percent of an activity area" and that "research guidelines such as those contained in Graham et.al. 1994" for coarse woody debris "should be used if more specific local guidelines are not available."

Forest Service Northern Region Approach to Soils Environmental Analysis Regarding Detrimental Soil Disturbance in Forested Areas: provides technical guidance covering a wide range of issues on how the detrimental soil disturbance standards are to be applied for environmental analyses in forested areas of the Forest Service Northern Region.

Detrimental soil disturbance and revised best management practices for the Gallatin National Forest (Keck 2012) (the third edition of this forest level technical guide): addresses issues related to ensuring consistency in the identification of detrimental soil disturbance on Custer Gallatin National Forest lands and applicability to local soil conditions on the national forest.

Key Indicators and Measures

The key indicators for assessing soil resource differences among alternatives are:

- differences in projected amounts of management activities by activity type
- differences in amount of recommended wilderness
- differences in the type or types of management activities emphasized

Methodology and Analysis Process

The analysis assumes that higher levels of certain vegetation treatments activities have a higher potential for creating greater amounts and more severe detrimental soil disturbance. In particular, selected activities associated with timber harvesting such as the construction of new temporary roads, timber processing, large slash pile burning at landings, and some types of land scarification practices used for silvicultural purposes. Detrimental soil disturbance is management caused soil disturbance in vegetation management areas that persists on the landscape for an extended period of time (minimum of 40 years), unless restoration actions are taken and are severe and extensive enough to reduce soil productivity or the ability of the land to provide desired goods and services. The analysis also assumes that although some soil disturbance can occur from recreation activities, such as trail use and camping, most ground disturbing activities are limited in recommended wilderness areas, and these areas will have lower overall levels of detrimental soil disturbance. The analysis compares the relative projected amounts of vegetation treatments by treatment type, projected plan objectives, and the amount of recommended wilderness areas across alternatives.

Information Sources

A wide range of soil surveys cover various portions of the Custer Gallatin National Forest. They vary from the low quality, land type soil survey covering most of the Gallatin National Forest, to countywide soil surveys of varying ages covering much of the Custer portion of the national forest. No soil surveys occurred for the Absaroka-Beartooth Wilderness, adjacent lands on the Beartooth District, or most of the Lee Metcalf Wilderness. A high quality, comprehensive soil survey covering all lands within the Custer Gallatin National Forest is not available and an accurate soil survey information does not exist for much of the Custer Gallatin at this time.

Additional sources of land resource information used on the Custer Gallatin National Forest include 1:24,000 USGS topographic quadrangle maps, 1:100,000 scale Montana Bureau of Mining and Geology geologic quadrangle maps. This also includes the soils and land management based modified version of this coverage created by the Custer Gallatin for the Greater Yellowstone Area watershed sensitivity analysis to potential climate change impacts. Other map data include archived aerial photography as well as current satellite imagery from National Agricultural Inventory Program and Google Maps imagery.

Analysis Area

The spatial analysis area for soils related comparisons among alternatives encompasses lands in the Custer Gallatin. Cumulative effects consider neighboring Federal land jurisdictions. Distinctions are not made as to where specific ground disturbing management activities may occur, nor are there any expectation for that type of analysis at the forest plan level.

The temporal scope of the soils analysis is the anticipated life of the plan. Effects of past management activities dating as far back as the 1950s have been used in project-level environmental analyses. Thus, the temporal boundary for indirect and cumulative effects going backward could be as long as 70 years.

3.3.2 Affected Environment (Existing Condition)

The description of soils existing conditions on the Custer Gallatin National Forest is divided between montane and pine savanna portions. Montane ecosystems of the Custer Gallatin include the Madison, Henrys Lake and Gallatin Mountains geographic areas; the Absaroka Beartooth Mountains geographic area; the Bridger, Bangtail, and Crazy Mountain geographic area; and the Pryor Mountain geographic area. The pine savanna ecosystem includes the Ashland geographic area and the Sioux geographic area.

Montane Areas

Most of the Custer Gallatin National Forest land area consists of mountainous areas of the Northern Rocky Mountains. These areas are characterized by the prevalence of hard bedrock that is resists erosion. The combination of an active tectonic area and the abundance of erosion resistant bedrock has resulted in the rugged topography of montane areas. These areas are often characterized by spectacular areas of exposed bedrock on ridgelines and along narrow canyons. Due to the rugged topography, much of the National Forest System land in this part of the Custer Gallatin has been largely inaccessible to management activities such as road building, timber harvesting, and even cattle grazing. Approximately two-thirds of the montane portion of the Custer Gallatin is currently protected from selected management activities through wilderness, wilderness study, or inventoried roadless area designations.

Management activities restricted by wilderness or wilderness study designations are often those with the highest potential to create significant amounts of persistent, detrimental soil disturbance. Shallow soils, steep terrain, and the resulting abundance of hard rock fragment in soils of the montane areas reduce growth potential for conifers. Those same factors also restrict grazing opportunities while at the same time limit the potential for certain types of detrimental soil disturbances to occur, specifically detrimental soil compaction or excessive soil erosion on low to moderately steep slopes. On the other hand, steep to very steep slopes and long slope lengths which also occur in montane areas, increase the potential for soil erosion and landslides (both naturally and in response to ground disturbance), regardless of the amount of rock fragments in the soil.

From an area wide perspective, limited access (whether based on jurisdictional or physical constraints), has kept overall average detrimental soil disturbance levels low for montane potions of the Custer Gallatin. The same factors, however, tend to concentrate the majority of management activities and activity caused soil disturbance onto a relatively small land base. Because of this, many of the current timber management projects and some proposed projects are a second entry into lands that have been harvested previously. At a project level, some of these lands, especially those in readily accessible areas with soils prone to specific types of detrimental soil disturbance, can have preexisting detrimental soil disturbance levels close to or exceeding the Northern Region detrimental soil disturbance standard prior to implementation of new management activities.

Pine Savanna Areas

Pine savanna areas on the Ashland and Sioux geographic areas have primarily been managed for cattle grazing, as well as timber harvesting. This is largely due to limited growth potential of the predominantly ponderosa pine forests growing in semi-arid areas of southeast Montana and northwest South Dakota. Lack of locally available timber mills within a reasonable haul distance also limits timber harvesting on the Sioux District (Kurt Hansen, District Ranger on Sioux District Custer Gallatin National Forest, personal communication).

Stands that support the growth of conifers in sufficient quantity and with reasonable growth potential on the pine savanna occur primarily in sandstone areas and north tending landscapes. Ponderosa pine can also be found growing on shale in some instances, but growth rates in shale areas are often reduced. Soils formed in sandstone areas, as a whole, are fairly resistant to certain types of detrimental soil disturbance so long as timber harvesting or other management activities do not occur on steep slopes. The same cannot be said about areas of shale. Other local parent materials of limited extent include porcelanite (locally known as scoria), quartzite, and floodplain deposits along rivers that generally do not support ponderosa pine. Although soil salinity issues are common throughout much of this geographic area, in general, they are restricted to lower elevations outside the national forest boundary.

Only a limited amount of soil monitoring has been conducted in pine savanna areas of the Custer Gallatin. These data, which are summarized by Robinson (2011) indicate only low levels of detrimental soil disturbance in the past timber harvest areas sampled. It is unknown at this time if soil detrimental soil disturbance monitoring has been conducted in pine savanna areas to assess relative impacts of cattle grazing. Overall, the limited evidence available would indicate cattle grazing on the pine savanna districts has not created substantial soil impacts in terms of high detrimental soil disturbance levels except in some areas of highly erodible, wet, or clayey soils.

3.3.3 Environmental Consequences

Current Plans

Management Direction under the Current Plans

Forest plan direction in the current 1986 Custer Forest Plan and 1987 Gallatin Forest Plan, as amended, provide limited direction for the management of soil resources. Between the two forests, this direction can be paraphrased as follows: maintain soil resources and watersheds in a desirable condition, maintain or improve soil productivity, best management practices will be applied, and forest soil survey be incorporated into resource analysis. The current direction with regard to the use of existing soil surveys will in many instances provide inaccurate information.

Effects of the Current Plans

Under the current plans, the Northern Region 15 percent maximum allowable detrimental soil disturbance standard will continue to apply to all vegetation activity areas and treatment units as directed by the Norther Region supplement. Direction in the Norther Region approach to soils environmental analysis regarding detrimental soil disturbance in forested areas will also continue to be followed for all timber harvesting projects. Technical guidance at the national forest level will be documented with respect to the consistent field identification of detrimental soil disturbance based on measurable field criteria, the use of appropriate field sampling procedures, and effective soil mitigation measures that are based on soil and land disturbance types.

Most of the direction at the national forest level would remain in place under the current plans, but only as technical guides outside of forest plan direction. There will remain a critical lack of forest plan direction needed to ensure that appropriate soil management, mitigation, and restoration procedures are followed. This casts doubt about the effectiveness of mitigation actions that would be taken in the future to protect soil and land productivity under the current plans and increases the likelihood that the 15 percent maximum detrimental soil disturbance standard would be exceeded in activity areas as a result of management activities.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

All revised plan alternatives include the 15 percent detrimental soil disturbance threshold for new vegetation management activities, numerical coarse woody debris targets (based on Northern Region broad vegetation type groups), and guidelines specifically designed to protect the diverse soil resources of the Custer Gallatin National Forest. Guidelines address the major sources of activity caused detrimental soil disturbance found on Custer Gallatin National Forest lands. Management approaches in appendix A of the draft revised plan provide additional information on effective mitigation strategies for implementation of soil plan components.

Effects Common to the Revised Plan Alternatives

Similar to the current plans, the 15 percent maximum allowable detrimental soil disturbance standard would apply to all vegetation management activity areas and treatment units under all revised plan alternatives. Including this standard at the forest plan level would help to increase forest-wide understanding of the detrimental soil disturbance concept and how it applies to management activities.

The revised plan alternatives add soil standards and guidelines that are not present in the existing Gallatin or Custer Forest Plans. Their inclusion in the revised forest plan would help move the Custer Gallatin towards more of an ecological land management approach. Restricting maximum detrimental soil disturbance levels within riparian management zone areas to less than 12 percent maximum would reduce the level of ground disturbance in riparian areas. However, it would still allow for management actions that benefit the riparian corridor, including the use of appropriate types and amounts of soil disturbance. This standard assumes that much of the 12 percent detrimental soil disturbance, when encountered, would be the result of prior management activities.

Guidelines proposed in the revised plan alternatives address the primary sources of detrimental soil disturbance that have occurred on the Custer Gallatin National Forest in the past. These include disturbance along temporary roads and disturbance at landings, especially large burn pile footprints left behind after pile burning. They also cover the extreme instances of improper land scarification practices that were previously used. On the montane portion of the Custer Gallatin, where either abundant hard rock fragments or hard bedrock frequently occurs at shallow depths, has the potential to cause extreme negative impacts on soil resources due to detrimental soil displacement. In addition, the current use of whole tree yarding and associated burning of large slash piles at landings can also create major disruption of soil processes needed to restore productive potential of the landing burn pile footprint. The primary adverse effect in this case relates to a deep wood ash layer that is left behind after burning. More explanation of potential effective mitigation actions after burning are outlined in management approaches in appendix A of the draft revised forest plan.

Soil guidelines in the revised plan alternatives protect soil productivity by means such as restricting skid trails from running up and down slopes on grades steeper than 35 percent, incorporating standard topsoil salvaging procedures when an actual soil pit or open trench is created during a management activity, and ensuring the retention of coarse woody debris left on the ground after timber harvesting.

Ensuring that adequate levels of coarse woody debris are retained on the ground in conifer stands after timber harvesting plays an important role in maintaining soil fertility for conifers. A range of coarse woody debris levels is provided in the revised plan alternatives by Northern Region broad potential vegetation group. These recommendations mirror to some extent data from Graham et al. (1994). The low end of each range can be thought of as representing appropriate levels of coarse woody debris for near-term fuels benefit while the upper end represents appropriate levels of coarse woody debris for maximum soil and land productivity benefit. Forest managers can decide, based on a vegetation management project's purpose and need, which end of the spectrum they need to pursue. Maintaining soil fertility in conifer stands could have an effect on future wildfire conditions. Without adequate soil fertility, replacement stands for many conifer species may trend more towards higher stand densities with smaller diameter trees that fail to adequately differentiate size classes and end up creating as an even greater wildfire threat in the future.

Overall, soils plan components in the revised plan alternatives are intended protect soil productivity while allowing management flexibility with respect to mitigating soil disturbance. There is no one size fits all mitigation strategy given the large amount of spatial variability in soil resources throughout much of the Custer Gallatin National Forest. While ripping and re-contouring the road prism may be the best approach in one area, it can actually create additional resource damage in very rocky soils due to the sorting of material that was cast downslope. Other strategies such as windrowing, ripping without recontouring, or simply breaking up the continuity of a temporary road left intact may be preferred strategies in certain instances, depending on soil and site conditions.

Revised plan alternative soils plan components would help ensure that timber harvesting units under all revised plan alternatives meet the 15 percent maximum detrimental soil disturbance standard, to both protect soil productivity and promote ecological integrity.

Consequences to Soils from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Vegetation, Timber, and Invasive Species Management

The current plans and alternatives B and C propose the same projected levels of timber and wood product quantities, wetland restoration, noxious weed treatments, projected fuels and timber management treatments, aspen, whitebark pine or other vegetation enhancement activities, and projected miles of road removal.

Alternative D objectives reduce the volume of timber and wood products while increasing vegetation management activities that have the greatest potential to improve the overall health, resiliency, and sustainability of land resources. Alternative D objectives increase acres of wetland restoration, noxious weed treatments, hazardous fuels treatments, pre-commercial thinning, prescribed burning, and other vegetation treatments designed to enhance species of interest (such as quaking aspen). These activities also have important positive effects on soils. Wetland restoration often requires the reestablishment of hydric soil conditions that not only support hydric vegetation in the wetland area itself, but also increases overall soil productivity in surrounding areas. Quaking Aspen stands, on true aspen sites, can accumulate a substantial amount of organic carbon in the soil down to a depth of three to four feet. In turn, high organic matter levels directly contribute to the high biomass production of these sites. Extreme wildfire activity often results in large areas of high severity burning at the forest floor that consumes much of the existing organic matter at the soil surface and in surface soil horizons. This creates hydrophobic surface soil conditions that limits the infiltration of water into the soil for an extended period. Depending on local terrain and other factors, these conditions have the potential to cause substantial soil erosion, including gully erosion, mud or debris flows, and loss of soil organic matter. Prescribed burning, hazardous fuels treatments, and pre-commercial thinning are all designed reduce the likelihood of high severity burning due to wildfires while enhancing rather than damaging soil productivity.

The relationship between noxious weeds and soils is tightly intertwined. Certain types of soil disturbance (especially disturbance that exposes low quality subsoil or substrate materials or otherwise creates unsuitable surface soil conditions for establishment of native, perennial plants) will almost invariably result in localized noxious weed infestations. These become the infestation sites from which the subsequent spread of noxious weeds to surrounding areas originate in a classic source-sink fashion. In return, the presence of dense noxious weeds populations such as spotted knapweed, Dalmatian toadflax, or Canada thistle at landings, along temporary roads, or on hillsides are often accompanied by evidence of accelerated erosion due to poor ground cover in these areas. The presence of noxious weed seed in the soil, especially at high concentrations, becomes a biological property of the soil. Although this alone would not be considered detrimental soil disturbance in accordance with the 1999 Northern Region supplement, it does reduce soil productivity and at high levels, limits land management options.

Alternative E increases the volume of both timber and wood products. To achieve the higher timber volumes in alternative E, timber harvesting would likely harvest larger trees and the overall forested acreage within treatment units would likely be smaller than treatments with more of a mixed forest health or fuels purpose and need. Despite the smaller footprint, however, the likelihood exists that the extent, severity, and persistence of detrimental soil disturbance created in a more concentrated setting will likely be greater within treatment units and along temporary roads. The major sources of detrimental soil disturbance created as a result of vegetation management practices on forest lands occur in association with timber harvesting. This is due in part to inherent vulnerabilities of soil resources on much of the Custer Gallatin Forest. Detrimental soil disturbance is most likely to occur in association with large burn pile footprints at landings, soil displacement along temporary roads, and potentially soil scarification (which has been used in the past to create suitable seedbeds for conifers on soils that were highly susceptible to this specific type of resource damage). These will continue to be the major soil resource concerns going forward.

Alternative E plan objectives propose the lowest levels of all alternatives for forest health and fuels treatments, wetland restoration, noxious weed control, prescribed burning, or enhancement for plant species of interest. Reductions of all the above have potential to negatively impact overall soil quality. Of specific concern is the projected reduction in weed control acres, which would create a compounding effect where less weed control in turn leads to an even greater rate of noxious weed spread on the national forest as well as adjacent lands.

There are no substantive differences among all alternatives with regard to potential livestock grazing impacts.

In summary, alternative D projects the highest level of activities with a beneficial soils association; alternative E projects the lowest level of these activities. The activity level in the current plans, alternatives B, and C range toward the middle of alternatives D and E. Post treatment, soil disturbance levels within vegetation treatment areas under revised plan alternatives would be expected to meet the Northern Region detrimental soil disturbance standard (less than 15 percent detrimental soil disturbance) based on the soil plan components provided in revised plan alternatives. While the current plans have the same requirement (less than 15 percent detrimental soil disturbance) per regional policy, the revised plan alternatives are more explicit in defining how to meet that standard.

Effects from Land Allocation of Recommended Wilderness

Recommended wilderness areas limit activities such as timber harvest and road construction that have the potential to create detrimental soil disturbance. Detrimental soil disturbance does occur in wilderness areas, often associated with trail use and camping areas. These uses can have localized severe impacts that tend to be congregated around popular alpine lakes or heavily used trails. Although overall levels of detrimental soil disturbance created are lower, mitigation actions to reduce soil and vegetation disturbance are more difficult to complete in wilderness or recommended wilderness areas due to limited access and restrictions on the use of mechanized equipment.

Alternatives vary from no recommended wilderness areas (alternative E) to over 700,000 acres of recommended wilderness areas (alternative D). Alternative D would have the most area of land where ground-disturbing activities would be limited. In addition, under alternative D the most miles of trails in recommended wilderness areas would no longer be available to mechanized and motorized recreation use, thereby reducing potential soil disturbance from these activities. Opportunities for hiking and horse use, which also have the potential to create soil disturbance, do not vary among the alternative considered. Overall, the potential to limit detrimental soil disturbance due to the recommended wilderness area allocation is highest in alternative D, followed by alternatives C, B, the current plans, and then E, which has no recommended wilderness areas.

Cumulative Effects

Much of the western part of the Custer Gallatin is adjacent to or near other Federal jurisdictions with similar requirements to protect soil productively. The Custer Gallatin is adjacent to the Beaverhead-Deerlodge, Helena-Lewis and Clark, Shoshone and Caribou-Targhee National Forests. All national forests are required by the National Forest Management Act to avoid substantial and permanent impairment of the soil. The other Northern Region National Forests, the Beaverhead-Deerlodge and Helena-Lewis and

Clark National Forests, also apply the 15 percent detrimental soil disturbance threshold. In Yellowstone National Park, natural processes operate in an ecological context.

The Bureau of Land Management has Resource Management Plans for lands near the Custer Gallatin, which are managed by the Butte (2009), Billings (2015), Dillon (2006), Miles City (2015) and South Dakota (2015) field offices. These plans contain components related to maintaining or improving soil health and productivity and minimizing soil erosion; therefore, they would be complementary to the plan components for the Custer Gallatin.

Conclusion

The current plans would continue the limited plan direction concerning the protection of soil resources.

Alternative D would likely result in the lowest level of potential detrimental soil disturbance overall than any other alternative considered because this alternative proposes the lowest level of vegetation treatment types that have a higher potential for creating greater amounts of detrimental soil disturbance. This alternative proposes the highest level of recommended wilderness, which limits most ground disturbing activities that have a high potential to create detrimental soil disturbance. Alternative D also emphasizes restoration and noxious weed treatments.

Alternative E would have the greatest potential to negatively impact soil resources of the revised plan alternatives due to the projected reduction in management activities such as noxious weed control and treatments that improve forest health. While alternative E has the highest level of timber harvesting activities with the potential to create soil disturbance in concentrated areas, soils plan components would increase the likelihood that post treatment, soil disturbance levels within all vegetation treatment areas would meet the Northern Region detrimental soil disturbance standard (less than 15 percent detrimental soil disturbance).

In conclusion, the revised plan alternatives plan components would protect soil productivity of vegetation treatment unit areas. Alternative D provides the greatest level of soils benefit, followed by alternatives B and C and the least benefit is provided by alternative E.

3.4 Watershed, Aquatic Species and Habitat, and Riparian Ecosystems

3.4.1 Introduction

This section considers the physical, chemical, and biological resources in aquatic and riparian ecosystems and watersheds on the Custer Gallatin National Forest. Managing for high quality water, intact and productive aquatic species habitat, native and non-native desirable species, and high quality riparian areas is integral to maintaining and enhancing watershed health.

For planning purposes, the revised plan arranges the Custer Gallatin National Forest into six distinct geographic areas ranging from roughly 78,000 acres to 1.4 million acres. Ecologically, the Custer Gallatin has termed its mountainous area as “montane” and the eastern districts as “pine savanna.” Montane ecosystems of the Custer Gallatin include the Madison, Henrys Lake, and Gallatin Mountains Geographic Area; the Absaroka Beartooth Mountains Geographic Area; the Bridger, Bangtail, and Crazy Mountain

Geographic Area; and the Pryor Mountain Geographic Area. The pine savanna ecosystem includes the Ashland Geographic Area and the Sioux Geographic Area.

These two ecosystem areas are nested within the broader ecoregions (Environmental Protection Agency Level III Ecoregions). An ecoregion provides a larger scale for planning and analysis that distinguishes common climatic and vegetation characteristics. Approximately 81 percent of the Custer Gallatin is in the middle Rocky Mountains, consisting of coniferous forest, alpine meadow, and shrubland-grassland steppe. Approximately 19 percent of the Custer Gallatin National Forest is in the Northwest Great Plains Province, consisting of ponderosa pine and shrubland-grassland steppe. A small amount of the national forest (less than 1 percent) is in the Wyoming Basin Province around the Pryor Mountains, consisting of semi desert shrubland-grassland.

Across this enormous landscape resides the broadest diversity of aquatic and riparian ecosystems and species in the Northern Region of the Forest Service, ranging from glacial meltwaters to intermittent prairie streams. In addition to the ecosystem services they provide, these aquatic and riparian ecosystems offer a variety of social and economic benefits to local, national, and international communities.

The montane landscape is drained by five major rivers, the Yellowstone, Boulder, Shields, Gallatin, and Madison Rivers. The Yellowstone River flows northeast from Yellowstone National Park. It follows a large, gently sloping valley between the Absaroka and Gallatin Mountain Ranges. The Boulder River flows northward from the Absaroka and Beartooth Mountain ranges. The Shields River originates in the western part of the Crazy Mountains and flows south into the Yellowstone River, near the town of Livingston. The Gallatin River, which originates in Yellowstone National Park and flows northward, divides the Gallatin and Madison Mountain Ranges. The Madison River originates in Yellowstone National Park and flows west through Henrys Lake Mountains, near the town of West Yellowstone.

The pine savanna landscape has nine distinct and isolated Forest Service land parcels amongst the Ashland and Sioux Geographic Areas. Though these units are geographically isolated, they contain ecologically important headwater streams, springs, and wetlands that eventually flow into five major drainages of the Missouri River Basin. The Tongue River flows south starting in Wyoming in the Big Horn Mountains, flows through northern Wyoming and southeastern Montana and empties into the Yellowstone River at Miles City, Montana. The Powder River flows south starting in Wyoming, in the Big Horn Mountains, and flows through northern Wyoming and southeastern Montana and empties into the Yellowstone River 50 miles downstream of Miles City, Montana. The Little Missouri River flows northeast from Wyoming near Devils Tower across a corner of southeastern Montana, into North Dakota, and eventually joining the main channel of the Missouri River about 25 miles northeast of Killdeer. The Grand River flows east starting in northwestern South Dakota, joins the Missouri in Lake Oahe, approximately 2 miles northwest of Mobridge. The Moreau River flows east starting in northwestern South Dakota and joins the Missouri in Lake Oahe, with the lower 25 miles of the river forming an arm of the reservoir.

Across elevations in the montane units watershed hydrology is strongly dependent on timing and magnitude of seasonal snowmelt (generally occurring in April and May). For example, in the Beartooth District, an average of about 31 inches of precipitation falls at the Cole Creek SNOTEL site (site with a weather station that measures precipitation and snowpack) (elevation 7,850 feet), whereas about 29.5 inches of annual precipitation are received at the Burnt Mountain SNOTEL site (elevation 5,880 feet). The elevation difference between these two sites translates to a significant difference in the ratio of precipitation falling as rain versus snow. Over 50 percent of Cole Creek's precipitation occurs as snow, whereas only approximately 13 percent of the precipitation falling at Burnt Mountain occurs as snow. While the above-mentioned SNOTEL sites exemplify the elevation control on precipitation in the area, these stations are not representative of average annual precipitation across the entire montane units of the Custer Gallatin.

The pine savanna units occur in southeastern Montana and into western South Dakota and as such, the physical and hydrologic characteristics are much different from the montane units. Surface flow regimes throughout the Ashland and Sioux Geographic Areas are largely ephemeral and intermittent. Average annual precipitation is approximately 13 to 17 inches, with precipitation increasing to the east and at higher elevations (High Plains Regional Climate Center[8]). While minor peak flows resulting from snowmelt are common, short duration high-intensity precipitation events (often from summer thunderstorms) can produce substantial peak flow events in small watersheds around the Ashland area. Such events have been documented by Parrett and Johnson (2004) and Efta (2016) in both post-wildfire settings (2014) as well as in absence of wildfire (2015). This suggests that storm characteristics may have an overriding influence in some cases. While not well understood, sediment transport processes likely follow these sporadic flashy events; sediment delivery to and conveyance through draws and channels appears to be largely periodic and tends to occur in large pulses such as during debris flow events. Head cut initiation (a form of erosion) has been observed in numerous locations across the Ashland and Sioux Districts where between one and two-tenths of a square mile drainage area are contributing upstream. Below these head cuts, a transition to riparian or wetland vegetation is commonly encountered, generally signaling a decrease in water table depth relative to surface elevation.

Regulatory Framework

Organic Administration Act of 1897: states that one aspect of the mission of the national forests is to "provide favorable conditions of water flow."

Clean Water Act of 1948, as amended: the principal law concerned with polluting activity in the nation's streams, lakes, and estuaries. Originally enacted in 1948, it has been revised by amendments in 1972 (Pub. L. 92-500) that gave the act its current form and spelled out ambitious programs for water quality improvements that are now being put in place by industries and cities. Congress refined these amendments in 1977 (Pub. L. 95-217) and 1981 (Pub. L. 97-117). The 1987 amendments added:

- Section 319, under which states are required to develop and implement programs to control non-point sources of pollution, or rainfall runoff from farm and urban areas as well as construction, forestry, and mining sites.
- Section 303(d), which requires states to identify pollutant-impaired water segments and develop TMDLs that set the maximum amount of pollution that a waterbody can receive without violating water quality standards; develop a water-quality classification of streams and lakes to show support of beneficial uses; and establish anti-degradation policies that protect water quality and stream conditions in systems where existing conditions exceed standards.

Federal Water Pollution Control Act, as amended: provides direction intended to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Sections 303, 319, and 404 apply to forest management activities. Section 208 of the 1972 amendments specifically mandates identification

[8] http://www.hprcc.unl.edu/

and control of non-point source pollution resulting from silvicultural activities. There are five required elements:

- Compliance with state and other Federal pollution control rules.
- No degradation of instream water quality needed to support designated uses.
- Control of non-point source water pollution using conservation or “best management practices.”
- Federal agency leadership in controlling non-point source pollution from managed lands.
- Rigorous criteria for controlling the discharge of pollutants into the nation’s waters.

Multiple-Use Sustained-Yield Act of 1960: Congress has affirmed the application of sustainability to the broad range of resources over which the Forest Service has responsibility. The Multiple-Use Sustained-Yield Act confirms the Forest Service’s authority to manage the national forests and grasslands “for outdoor recreation, range, timber, watershed, and wildlife and fish purposes” (16 U.S.C. 528) and does so without limiting the Forest Service’s broad discretion in determining the appropriate resource emphasis or levels of use of the lands of each national forest and grassland.

Sikes Act of 1960 (16 U.S.C. 670a): This act provides for carrying out wildlife and fish conservation programs on Federal lands, including authority for cooperative state and Federal plans and authority to enter into agreements with states to collect fees to fund the programs identified in those plans.

National Environmental Policy Act (NEPA) of 1969: This act requires the analysis of projects to ensure that the anticipated effects upon all resources within the project area are considered prior to project implementation (40 CFR 1502.16).

Endangered Species Act of 1973, as amended: Section 7(a)(1) supports biotic sustainability by requiring that “all… Federal agencies shall… utilize their authorities in furtherance of the purposes of this act by carrying out programs for the conservation of endangered species and threatened species.” Section 7(a)(2) of the Endangered Species Act includes direction that Federal agencies, in consultation with the USFWS, will not authorize, fund, or conduct actions that are likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of their critical habitat.

National Forest Management Act of 1976: This act directs the Forest Service to manage for a diversity of habitat to support viable populations (36 CFR 219.19). Regulations further state that the effects on these species and the reason for their choice as management indicator species need to be documented (36 CFR 219.19(a)(1)).

Safe Drinking Water Act of 1977 and amendments (1996): In 1996, the Safe Drinking Water Act was amended with requirements to identify “Source water protection areas” and to assess their susceptibility of contamination. This provides states with more resources and authority to enact the Safe Drinking Water Act. This amendment directs the state to identify source water protection areas for public water supplies that serve at least 25 people or 15 connections at least 60 days a year. In terms of relative size and scope, while an individual national forest unit may have 4 designated municipal watersheds, there may be over 100 source water protection areas that intersect with that National Forest System lands managed by that unit.

Source water protection areas have been established to protect public water systems from contamination. Public water systems are defined as entities that provide "water for human consumption through pipes or other constructed conveyances to at least 15 service connections or serves an average of at least 25 people for at least 60 days a year.” The term "public" in "public water system" refers to the people drinking the water, not to the ownership of the system (www.epa.gov/sourcewaterprotection). These systems can be dependent on any type of water source, including streams, lakes, reservoirs, springs, wells, or infiltration galleries, and include systems used either year-round or only seasonally.

State governments were given the option to accept primacy or responsibility for delineating and developing assessments for these source water protection areas. Montana and South Dakota have accepted this responsibility and should be contacted for the most up-to-date information regarding the source water protection delineations, assessments, and management requirements or goals.

Municipal Watersheds – 36 CFR 251.9: authorizes the chief of the Forest Service to enter into agreements with municipalities to restrict the use of National Forest System lands from which water is derived to protect the municipal water supplies (Forest Service Manual 2542).

Executive Order 11988 (May 24, 1977): directs Federal agencies take action on Federal lands to avoid, to the extent possible, the adverse impacts, in the short and long term, associated with the occupancy and modification of floodplains. Agencies are required to avoid the direct or indirect support of development on floodplains whenever there are reasonable alternatives and to evaluate the potential effects of any proposed action on floodplains.

Executive Order 11990 (May 24, 1977), as amended: requires Federal agencies exercising statutory authority and leadership over Federal lands to avoid, to the extent possible, the adverse impacts, in the short and long term, associated with the destruction or modification of wetlands. Where practicable, direct or indirect support of new construction in wetlands must be avoided. Federal agencies are required to preserve and enhance the natural and beneficial values of wetlands.

Executive Order 12962 (June 7, 1995): acknowledges the recreational value of aquatic biota by stating the objectives “to improve the quantity, function, sustainable productivity, and distribution of United States aquatic resources for increased recreational fishing opportunities” by “(h) evaluating the effects of federally funded, permitted, or authorized actions on aquatic systems and recreational fisheries and document those effects relative to the purpose of this order.”

Executive Order 13112 (Feb. 3, 1999): directs Federal agencies whose actions may affect the status of invasive species to prevent the introduction of invasive species and to detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner, as appropriations allow.

Administrative Rules of the State of Montana 16.20.603: states that best management practices are the foundation of water-quality standards for the state of Montana. The Forest Service has agreed to follow best management practices in a memorandum of understanding with the state. Many best management practices are applied directly as mitigation at the project level. Implementation and effectiveness monitoring of best management practices are routinely conducted by contract administrators and during other implementation and annual monitoring events.

Administrative Rules of the State of Montana 17.30, subchapter 6: details water-quality standards for the state of Montana. The Forest Service has primary responsibility to maintain these standards on lands under their jurisdiction in the state.

Montana Natural Streambed and Land Preservation Act of 1975, also known as the 310 law: requires any person planning on working in or near a perennial stream on public or private lands to first obtain a permit from the state.

Administrative Rules of the State of South Dakota 74:51:03: developed a beneficial uses classification system and associated water quality standards for ensuring that beneficial uses are protected.

Administrative Rules of the State of South Dakota 74:51:01:11: indicates wetlands are waters of the state and are allowed provisions under South Dakota water quality law. Multiple protection provisions apply to wetlands within state regulatory authority, including prohibition of pollutant discharge, aquatic nuisance species proliferation, and protection of biological integrity.

Administrative Rules of the State of South Dakota 74:51:01:02: states a person may not discharge or cause to be discharged into surface waters of the state pollutants that cause the receiving water to fail to meet the criteria for its existing or designated beneficial use or uses.

Administrative Rules of the State of South Dakota 74:51:01:34: outlines the anti-degradation policy for the state. Existing designated beneficial uses must be maintained and protected. No further reduction of water quality is allowed for surface waters of the state that do not meet water quality levels assigned to their designated beneficial uses. Item 6 of the policy notes that "the secretary shall assure that regulatory requirements are achieved for all new and existing point sources and that nonpoint sources are controlled through cost effective and reasonable best management practices."

Key Indicators and Measures

The differences between alternatives will be qualitatively evaluated by considering effects of forest plan direction and how well it supports and protects watershed, aquatic, and riparian values.

In addition, the varying level of plan objectives will be evaluated, including number of aquatic organism passage devices installed, number of acres or miles of stream of stream habitat improved, number of recreation facilities removed from the riparian management zones, and road conditions improved or decommissioned.

Methodology and Analysis Process

This analysis takes a programmatic look at the outcomes that might result from implementing the proposed management direction in each alternative over the life of the forest plan. The three watershed scales most relevant to the implementation of the forest plan are subbasin (8-digit hydrologic unit), watershed (10-digit hydrologic unit), and subwatershed (12-digit hydrologic unit). A subwatershed may range from 10,000 to 40,000 acres in size. For estimating the effects at the programmatic forest plan level, the assumption has been made that the kinds of resource management activities allowed under the alternatives are reasonably foreseeable future actions to achieve the desired conditions and objectives. However, the specific location, design, and extent of such activities are generally not known because these activities are made at the project level based on a site-specific analysis. Therefore, the discussions here refer to the potential for the effects to occur and are in many cases only estimates. The effects analyses are useful when comparing and evaluating alternatives, but are not intended to be applied directly to specific locations on the Custer Gallatin National Forest.

Since the site specificity of future activities are not known at the programmatic forest plan level, the potential spatial and temporal effects to water quality cannot be attributed to any specific watershed, nor can quantitative estimates of potential effects to aquatic resources be determined (such as changes in water quantity). Broad-scale estimated effects and trends related to hydrologic function and watershed processes for National Forest System lands within the project area have been qualitatively estimated. Cumulative effects to water quality are described in terms of their potential to generally affect trends on the subwatershed to basin scale.

Information Sources

This analysis draws upon the best available literature citations that were found to be relevant to the ecosystems on the Custer Gallatin National Forest. Literature sources that were the most relevant, most recent, peer-reviewed, and local in scope or directly applicable to the local ecosystem were selected. Uncertainty and conflicting literature was acknowledged and interpreted when applicable.

Analysis Area

The analysis area for watersheds, riparian management zones, and aquatic species includes all lands within the boundary of the national forest. The temporal scope of the analysis is the anticipated life of the plan. The cumulative effects analysis area includes Custer Gallatin lands and adjacent jurisdictions and landowners.

3.4.2 Affected Environment (Existing Condition)

Watersheds

Watershed Condition Framework

Watersheds and their ecological condition have been an increasingly important focus of public land managers in the last two decades (Reeves et al. 2006, Thomas et al. 2006, Esselman et al. 2011). Congress has also had increasing interest in watershed condition, especially when it comes to investment in watershed restoration. Nationally, in 2011 the Forest Service introduced two general technical reports responding to congressional interest. These reports are the Watershed Condition Framework (FS-977) (USDA 2011) and the Watershed Condition Classification Technical Guide (FS-978) (Potyondy and Geier 2011). These reports were developed in tandem to provide a consistent method for categorizing how the Forest Service identifies the condition of sub-watersheds as well as to provide broad guidance to help national forests select priority watersheds.

The watershed condition framework establishes a nationally consistent reconnaissance level approach for classifying watershed condition. It does so by using a comprehensive set of 12 indicators that are surrogate variables representing the underlying ecological, hydrological, and geomorphic functions and processes that affect watershed condition. The primary emphasis is on aquatic and terrestrial processes and conditions that Forest Service management activities can influence. The indicators use data when available and professional opinion when data is not available. The approach is designed to foster integrated ecosystem-based watershed assessments, provide guidance to programs of work in watersheds that have been identified for restoration, enhance communication and coordination with external agencies and partners, and improve national-scale reporting and monitoring of program accomplishments. The watershed condition framework provides the Forest Service with an outcome-based performance measure for documenting improvements to watershed condition at forest, regional, and national scales (USDA, 2011).

Watershed condition classification ultimately ranks watersheds in one of three discrete categories (or classes) that reflect the level of watershed health or integrity. Watershed health and integrity are considered conceptually the same (Regier 1993). Watersheds with high integrity are in an unimpaired condition in which the ecosystems show little or no influence from human actions (Lackey 2001).

The Forest Service "Watershed Protection and Management" Manual (USDA 2004) defines watershed condition in terms of "geomorphic, hydrologic and biotic integrity" relative to "potential natural condition." In this context, integrity relates directly to functionality. In this analysis, geomorphic functionality or integrity is defined in terms of attributes such as slope stability, soil erosion, channel morphology, and other upslope, riparian, and aquatic habitat characteristics. Hydrologic functionality or integrity relates primarily to flow, sediment, and water quality attributes. Biological functionality or integrity is defined by the characteristics that influence the diversity and abundance of aquatic species, terrestrial vegetation, and soil productivity. In each case, integrity is evaluated in the context of the natural disturbance regime, geoclimatic setting, and other important factors within the context of a watershed. The definition encompasses both aquatic and terrestrial components because water quality and aquatic habitat are inseparably related to the integrity and, therefore, the functionality of upland and riparian areas within a watershed.

Within this context, the three watershed condition classes are directly related to the degree or level of watershed functionality or integrity:

- Class 1: functioning properly
- Class 2: functioning at risk
- Class 3: impaired function

In this framework, a watershed is considered in good condition if it is functioning in a manner similar to one found in natural wildland conditions. This characterization would not be interpreted to mean that managed watersheds cannot be in good condition. A watershed is considered to be functioning properly if the physical attributes are appropriate to maintain or improve biological integrity. This consideration implies that a class 1 watershed in properly functioning condition has minimal undesirable human impact on natural, physical, or biological processes and is resilient and able to recover to the desired condition when or if disturbed by large natural disturbances or land management activities. By contrast, a class 3 watershed has impaired function because some physical, hydrological, or biological threshold has been exceeded. Substantial changes to the factors that caused the degraded state are commonly needed to set them on a trend or trajectory of improving conditions that sustain physical, hydrological, and biological integrity.

Watershed Conditions on the Custer Gallatin National Forest

The primary hydrologic unit upon which watershed condition has been assessed is the 6th-level hydrologic unit, or sub-watershed, which is a watershed of about 10,000 to 40,000 acres. To evaluate baseline watershed conditions across the analysis area, a watershed condition rating was determined for each sub-watershed. This characterization estimated the existing condition based on physical characteristics (for example, hydrologic, geomorphic, landscape, topographic, vegetative cover, and aquatic habitat) and human-caused disturbances (such as road construction and vegetative treatments).

The Custer Gallatin National Forest is located in 269 sub-watersheds. Eighty-one of these are in pine savanna geographic areas, while 188 are in montane geographic areas. Following the watershed condition class protocol in 2016, 221 watersheds were rated as functioning properly, 48 watersheds were rated as functioning at risk, and none was rated as impaired. Of the functioning at risk watersheds 20 (25 percent of pine savanna) were in pine savanna geographic areas, while 28 (14 percent of montane) were in montane geographic areas. Table 13 is a summary of watershed condition classes across the Custer Gallatin by geographic area.

Table 13. 6th-level watersheds rated in each condition class using the watershed condition framework

Geographic Area	Class 1	Class 2	Class 3	Total	% Watersheds in Class 2
Sioux	35	7	0	42	16
Ashland	26	13	0	39	33
Pryor Mountains	9	0	0	9	0
Absaroka Beartooth Mountains	72	12	0	84	14
Bridger, Bangtail, and Crazy Mountains	24	11	0	35	31
Madison, Gallatin, and Henrys Lake Mountains	55	5	0	60	0
Total	221	48	0	269	17

Some characteristics of channels commonly measured to help identify changes caused by management include the frequency and depth of large pools, the width-depth ratio of stream channels, and the percentage of fine sediment contained in the substrate (Al-Chokhachy et al. 2010). Low-gradient stream channels show the most response to land management activities. Lower pool frequencies and higher fine sediment concentrations are most obvious in watersheds with higher road densities. These findings are consistent with observations that indicate that past road construction and maintenance, grazing, and timber harvest practices alter sediment delivery and routing (and potentially other habitat components). This in turn, led to fewer pools, higher fine sediment content, and stream aggradation.

Water Quality

The states of Montana and South Dakota non-degradation policies states that existing and anticipated uses and the water quality, necessary to protect those uses, must be maintained and protected. Many, but not all, land management activities on National Forest System lands are considered nonsignificant activities under state laws as long as reasonable land, soil, and water conservation practices are applied and existing and anticipated beneficial uses will be fully protected.

Water quality is regulated under the authority of the Clean Water Act. States assess waters within their jurisdiction and identify stream segments and other waterbodies whose water quality is “impaired” or generally do not meet water quality standards for beneficial uses.

Individual stream segments, lakes, and other waterbodies have been listed as “water quality limited segments” (for example, “impaired”) by the states of Montana (MTDEQ 2010) and South Dakota and are described in subsection 305(b) and 303(d) of the Clean Water Act as waters that do not meet State standards. This broad term includes water quality criteria, designated uses, and anti-degradation policies. These impaired waterbodies are identified in a biennial integrated report that lists the status of water quality for waterbodies under state jurisdiction, which includes all National Forest System lands in their respective states.

The Montana Department of Environmental Quality and South Dakota Department of Environment & Natural Resources develop total maximum daily loads (TMDLs) and submits them to the United States Environmental Protection Agency for approval. A TMDL is the maximum amount of a pollutant a waterbody can receive and still meet water quality standards. Section 303(d) of the Clean Water Act requires advises the development of TMDLs for streams and lakes that do not meet, or are not expected to meet, State water quality standards. TMDLs provide an approach to improving water quality so that streams and lakes can support and maintain their state designated beneficial uses.

According to the Montana Department of Environmental Quality (DEQ) (MTDEQ 2016), 34 stream segments on the Custer Gallatin National Forest in Montana are not meeting water quality standards (table 14 lists stream segments by geographic area). There are no streams on the Sioux District in South Dakota (on Forest Service lands) that are listed with South Dakota Department of Environment & Natural Resources.

Table 14. 303(d) listed stream segments by geographic area*

Geographic Area	Number of stream segments	Sources of Pollutants	TMDL Assessments
Sioux	0	Not applicable	Not applicable
Ashland	1	Natural sources	Otter Creek
Pryor Mountains	0	Not applicable	Not applicable
Absaroka Beartooth Mountains	12	Largely impacts from mining and abandoned mine lands	Boulder River, Clarks Fork Yellowstone River
Bridger, Bangtail, and Crazy Mountains	9	Primarily agriculture and grazing.	Bear Creek, Jackson Creek, Bridger Creek, Shields River
Madison, Gallatin, and Henrys Lake Mountains	13	Primarily natural sources and forest road construction. Some silvicultural activities and grazing. Land development in the Big Sky area, none of which is on National Forest lands.	Hyalite Creek, West Fork Gallatin, South Fork West Fork Gallatin

* Montana Department of Environmental Quality 303 listing will change throughout the life of this plan

On the Montana DEQ list, 16 of these are listed for agriculture related impacts, 8 are mining (or abandoned mine lands) related, 3 are natural, 3 are national forest roads, 2 are irrigation, and the remaining 2 are land development impacts. A 303(d) listing does not necessarily indicate that Forest Service practices are contributing to the listing even when a stream segment intersects Forest Service lands. First, a 303(d) listing can, and does occur, when an initial analysis indicates there may be an impairment to beneficial use(s). It can then take the Montana DEQ some time to investigate this thoroughly and come up with a definitive conclusion, sometimes leading to that stream being taken back off the list. Second, when impairment has indicated the Custer Gallatin may be contributing to impairment, the Custer Gallatin staff has a history of addressing and resolving those issues. For example, Upper Taylor Creek (HUC 100200080107) and Lower Taylor Creek (HUC 100200080108) are on the 303 (d) list for sediment input to streams from Forest Service roads (as far as Forest Service impacts are concerned). The Forest Service has invested millions of dollars in those drainages decommissioning and rerouting roads, replacing culverts, and improving road surfaces. This has substantially decreased Forest Service road sediment sources such that all reasonable land, soil, and water conservation practices are satisfied for these roads in a manner that is consistent with state law and eventual recovery from sediment impairment to the stream. Impairment can no longer be attributed to on-going Forest Service practices, yet those streams remain on the list.

Groundwater

Groundwater-dependent ecosystems are communities of plants, animals, and other organisms that rely on access to or discharge of groundwater such as springs, fens, seeps, areas of shallow groundwater, cave and karst systems, hyporheic and hypolentic zones, and groundwater-fed lakes, streams, and wetlands.

Groundwater is an important resource in Montana and South Dakota, and it will likely become more important in the future as the states' population and industries grow. More than half of Montanans depend on groundwater for their primary water supply. According to the Montana Natural Resource Information Service, groundwater provides 94 percent of Montana's rural domestic water supply and 39 percent of the public water supply. Montana uses over 188 million gallons of groundwater per day for domestic use, public water supplies, irrigation, livestock, and industry (Hutson et al. 2005). Water generated in the mountains of the Custer Gallatin is an important source of recharge for valley aquifers and is therefore an important forest product.

The Custer Gallatin National Forest is also a source of groundwater whereby runoff, especially from snowmelt, will infiltrate soils and stream substrates to recharge downstream aquifers. Montana's mountains may receive two to three times the amount of precipitation as nearby lowland areas. Currently there is not enough data to numerically differentiate these snowmelt recharge events from the national forest versus deeper groundwater resources and which of those two has a larger impact on aquifers. However, hydrogeologic assessments (English and Marvin 2000, Marvin 2000, Schmechel 2015); indicate that in close proximity to surface water some springs and wells may be under direct influence of surface water recharge driven by snowpack accumulation and precipitation. Groundwater recharge to shallow aquifer systems (for example, hyporheic zones) has substantial importance to stream and river flow during base-flow in some cases being critically important for surface water quantity, water quality, and thermal buffering for aquatic biota.

Across the Custer Gallatin National Forest, it is currently assumed (due to relatively sparse populations, large amount of wilderness and remote terrain, and lack of industry currently using that resource on the Custer Gallatin) that groundwater extraction is not significantly drawing down aquifers. Monitoring in areas of high residential and commercial development and areas where industry needs to withdraw groundwater would determine the extent of potential impacts from those activities. There are very few natural sources of ground-water contamination. However, on the Custer Gallatin many streams and rivers of the Yellowstone Gallatin, and Madison River systems drain from Yellowstone National Park where surface water flow from geothermal areas can naturally discharge compounds that are hazardous to humans and potentially fish and wildlife as well. For example, wells in the Madison River drainage have arsenic and fluoride concentrations that exceed United States Environmental Protection Agency

(EPA) human health limits for arsenic and fluoride (Thompson 1979). Further, Schmechel (2015) found geothermal features within the south Hebgen Basin confined aquifer are releasing arsenic and fluoride in quantities above the EPA human health standard.

Despite little known human-caused effects to the groundwater resource at the forest plan level, there are some localized examples of effects on or near the Custer Gallatin. Adjacent to the Ashland District, in the Powder River Basin, there was a substantial increase in drilling and developing wells for coal bed methane production in the 2000s. This activity has dropped substantially, with 90 Montana wells producing methane and water in 2015 down from a peak of approximately 700 in 2008. Twenty-foot drawdown contours were found to extend a maximum of approximately 1.5 miles from the edge of producing coal bed methane fields, much less than the projected four miles. To date, monitoring data indicates that coal bed methane production has not affected groundwater table depth or groundwater quality on the southern end of the Ashland District (Kuzara et al. 2015). If this development activity, likely coinciding with changes in natural gas economy and industry, were to again increase and well(s) were being pumped on or adjacent to forest lands' groundwater resources may be impacted. Coal bed methane development requires withdrawing large volumes of groundwater to release the methane gas. (Myers 2009) found that drawdown of groundwater from coal bed methane fields could exceed 6m in depth and extend many kilometers beyond the well(s) or gas field affecting groundwater resources, wells, springs, and pumps. Additionally, replenishing of groundwater resources could take on the order of up to 50 years depending on various parameters such as geologic porosity.

The Sibanye Stillwater Mining Company's extensive palladium and platinum mine operations in the East Boulder and Main Stillwater drainages have rerouted groundwater pathways and altered groundwater quality and quantity. Montana Department of Environmental Quality and the Custer Gallatin National Forest cooperatively regulate and manage water resource impacts associated with mine infrastructure, and as such, surface water quality is maintained within state water quality standards. While much of the mine infrastructure is on private land adjacent to National Forest System lands, the ongoing Benbow Exploration Portal development is on National Forest System lands. Water from this development will be rerouted to the mine for treatment. Over approximately a five-year time span, produced water will be treated then injected into the regional Madison aquifer.

The Sioux Ranger District has three oil and gas wells, two in the North Cave Hills, and one in the South Cave Hills. One of the two wells in the North Cave Hills is a saltwater disposal well. No local surface water or groundwater effects have been observed (K. Hansen, District Ranger, Sioux Ranger District, and P. Pierson, retired Custer Gallatin National Forest Geologist, personal communication).

Lotic Waterbodies: Streams and Rivers

Streams and rivers (hereafter referred to as streams) are inherently tied to their valley (Hynes 1975), carrying water, sediment, dissolved minerals, and organic material derived from hillsides and the riparian areas adjacent to the stream channel. Thus streams have developed in more than the longitudinal (upstream-downstream) dimension and instead are active in four dimensions: longitudinal, lateral, vertical, and temporal (Ward 1989). Longitudinal refers to the simple movement of water, nutrients, and materials in the stream channel itself; lateral refers to the exchange of materials with riparian areas and uplands areas; vertical refers to the exchange of surface water and shallow groundwater, or hyporheic water; and finally temporal is highly variable, but refers to the time continuum constantly shaping and changing ecosystems ranging from evolutionary responses to succession after a disturbance event.

Further, moving from headwaters downstream biological organization adapts structurally and functionally to how energy is dissipated along the physical stream template (Vannote et al. 1980).

The shape and character of stream channels constantly adjusts to the flow of water and material by adopting distinctive patterns such as pools, riffles, runs, meanders, and step pools. The vast array of physical channel characteristics, combined with energy and material flow, provide diverse habitats for a wide array of aquatic organisms. Varied topography coupled with irregular occurrences of channel-affecting processes and disturbance events such as fire, debris flows, landslides, drought, and floods result in a mosaic of river and stream conditions that are dynamic in space and time under natural conditions. The primary consequence of most disturbances is to directly or indirectly provide pulses of or to rearrange sediment, gravels and cobbles, and organic matter and wood into stream systems. As a result, most streams and rivers undergo cycles of channel change on timescales ranging from inter-annual to hundreds of years in response to episodic inputs of wood and sediment. The types of disturbances that affect the morphology of a particular channel depend on ecoregion climate (for example, the Rocky Mountains vs the Northern Great Plains), watershed characteristics, size, and position of the stream within the watershed. Many aquatic and riparian plant and animal species have evolved in concert with stream channels. They develop traits, life-history adaptations, and propagation strategies that allow persistence and success within these dynamic landscapes.

Unique within the Northern Region are the pine savanna, as known in the scientific literature, prairie streams that occur in the Ashland and Sioux geographic areas. Prairie streams are an endangered yet valuable resource in the Northern Great Plains Ecoregion (Sampson and Knopf 1994, Dodds et al. 2004). Previous studies on prairie streams in the Northern Great Plains have shown prairie stream systems are very unpredictable, constantly changing from drying to flooding stages between seasons, sometimes even in a matter of days (Matthews 1988, Ostovar 2007). These systems have shown the need for multiple spatial and temporal sampling to occur along each stream for an adequate understanding of prairie stream assemblages (Ostovar, 2007). In-stream habitats are constantly changing in prairie systems (Matthews, 1988) and prairie fishes and other aquatic biota have adapted to the drying and flooding landscape of the prairie (Dodds et al. 2004).

Beavers, historically, were an integral part of stream ecosystems in North America, acting as ecosystem engineers where they modify the structure, function, and composition of streams. Their dam building can strongly modify habitats, make lentic habitats altering nutrient cycling dynamics (Naiman et al. 1994), alter fluxes of organic matter, sediment, and heat (Rosell et al. 2005), and increase overall bio-complexity (Wright et al. 2002, Malison and Baxter 2010). Beaver populations have declined across much of the Custer Gallatin due to trapping and reductions in woody forage species from livestock grazing impacts, road construction, and access-related activities (Pollock et al. 2015). Fire suppression is also a factor as riparian areas can convert from the cottonwood, aspen, green ash, and willow species preferred by beavers towards coniferous tree species under the prolonged absence of fire. This reduction in beaver populations in ecosystems adapted to their presence results in reduced and less resilient riparian and aquatic habitats (Bouwes et al. 2016). An estimated 50 percent of pine savanna stream miles have potentially suitable conditions to provide beaver habitat, whereas 30 percent of montane streams have these ratings (Engineering 2016). Although beaver are currently present in many of the stream reaches, identified by the model as being highly suitable habitat across the Custer Gallatin, occupied habitat is much less than the model projects. For example, on the pine savanna portion of the national forest, many of the stream reaches indicated as highly suitable have intermittent flow regimes, despite wetter than average conditions in the past five years, thereby violating the model assumption of reliable water supply (Efta and Layhee 2016). These reaches are roughly split between watersheds with fully functioning watershed condition framework ratings and those with functioning at risk ratings), indicating that although land management activities such as grazing may play a key role, particularly in modifying riparian vegetation and streambanks, underlying landscape variables (headwater prairie stream hydrology and geomorphology) also drive patterns. Therefore, the model is a useful starting point, but additional analysis and ground-truthing is required to refine the model to understand where and how beaver might be managed to restore aquatic habitat composition. Nonetheless, beaver do appear to inhabit less of the landscape encompassed by the Custer Gallatin than they did historically (Pollock et al. 2015).

Human uses have altered some stream channels in the last two centuries. Stream channels have changed as a result of channelization; dam building; wood removal; road, trail, bridge building; logging practices; water diversions for uses such as agriculture; fire suppression; and livestock grazing. Some characteristics of channels commonly measured to help identify changes caused by management include the frequency and depth of large pools, the width-depth ratio of stream channels, and the percentage of fine sediment contained in the substrate (Al-Chokhachy et al. 2010). Low-gradient stream channels show the most response to land management activities. Past road construction and maintenance, livestock grazing, and timber harvest practices can alter sediment delivery and routing, and potentially other habitat components, which in turn may lead to fewer pools, higher fine sediment content, and stream aggradation.

There are over 5,700 miles of streams and rivers on the Custer Gallatin. Of the mapped stream channels on the Custer Gallatin, 1,351 miles (24 percent) are considered ephemeral; about 57 percent of this amount is present on the pine savanna landscape, representing 63 percent of mapped channel on the pine savanna units. Conversely, ephemeral channels represent about 13 percent of montane streams. A similar pattern holds for intermittent streams, as 33 percent of pine savanna streams, but less than one percent of montane streams are intermittent. Four percent of pine savanna streams are perennial, as compared to 84 percent of montane. Overall, more than 4,300 miles of intermittent and perennial stream are present on the Custer Gallatin, and expected to express riparian vegetation.

The most comprehensive and consistent data set on stream channel conditions is provided by the PacFish Infish Biological Opinion (PIBO) monitoring program, which is a highly organized monitoring effort that collects data systematically across National Forest System and Bureau of Land Management lands. This program allows the evaluation of status and trends and comparison of reference and managed conditions at the stream reach scale. A draft analysis of stream habitat conditions on the Custer Gallatin National Forest using the PIBO data was completed in 2016 (Archer and Ojala 2016a;b). Monitoring began on the Custer Gallatin in 2005 and includes 43 managed sites and 22 reference sites in montane watersheds as well as 22 managed sites in the pine savanna units. The pine savanna units do not have reference sites because nearly all acres on the Custer Gallatin have an ongoing history of land-use, particularly livestock grazing. Additionally, the PIBO protocol was developed specially for salmonid streams, not warm-water prairie streams that occur in the two eastern units of the Custer Gallatin. Trend data at these pine savanna sites are being analyzed to determine best indicators of trend for pine savanna systems. The goal will be for the PIBO team and Custer Gallatin National Forest watershed staff to continue to work together to develop a robust monitoring program built on the PIBO principle that addresses the unique stream systems of the pine savanna units.

PacFish Infish Biological Opinion (PIBO) data for Custer Gallatin National Forest montane streams shows the overall index of habitat condition (a composite of measured habitat values) for montane stream reaches shows that managed watersheds (watersheds exposed to disturbance from various management actions) have habitat conditions about 15 percent lower than reference sites (relatively pristine watersheds that are used as a benchmark of expected condition). The distribution of biological integrity scores is skewed to a lesser extent, about 5 percent, with a similar range of biological integrity scores between managed and reference sites. Overall, about 60 percent of managed watersheds had a biological integrity similar to "pristine" conditions, whereas about 80 percent of reference watersheds met that criterion. Taken together, these patterns confirm that land management activities do imprint on Custer Gallatin aquatic habitat conditions, but also that disturbance is a natural occurrence (hence the range of habitat and biotic conditions at reference sites). Indeed, disturbance is often the agent that replenishes critical habitat elements, such as large woody debris and streambed substrates (Kreutzweiser et al. 2012). Further, pristine (for example, unmanaged) systems may actually exhibit a wider range of conditions than more heavily managed systems (Lisle 2002).

Lentic Waterbodies: Lakes, Wetlands, and Reservoirs

Lentic waterbodies, which include natural lakes, wetlands, and constructed reservoirs, are prominent features on the Custer Gallatin National Forest landscape. The Custer Gallatin National Forest has a diversity of these habitats ranging from large montane lakes such as Hebgen Lake just outside the town of West Yellowstone to the hundreds of alpine lakes on the Beartooth Plateau to ponds with warm-water fish on the eastern units.

Lentic habitats on Custer Gallatin pine savanna landscapes are largely the result of constructed reservoirs (such as Mud Turtle and Rabbit Creek Reservoirs, Black's and Brown's Ponds). Since the early 1900s, and in particular post WWII, hundreds of thousands of reservoirs have been built across the northern great plains, largely for livestock watering demands, but also for sport-fishing ponds and other uses. Many were also built for concerns over potential floods. These reservoirs often block stream channels. Whether that flow is perennial, intermittent, or even less regular, these structures change the landscape. Overall, the large number of reservoirs across eastern Montana and western South Dakota, including on the Custer Gallatin National Forest, has had a dramatic influence on natural hydrologic processes. The Custer Gallatin pine savanna units have 195 constructed dams and reservoirs that block stream channels of varying size and flow characteristics. Additionally, there are 25 recorded dugouts (areas often in depression or swales of stream channels that will catch water for livestock use). As reservoirs fill with sediment or the dams are breached (as these earthen structures are not permanent) some agencies or landowners are deciding to discontinue the use of these reservoirs and breach dams or reclaim and restore stream channels. Within the life of this forest plan, the Custer Gallatin National Forest will have to make decisions and weigh cost verses benefits, at the project scale, as some of these damns will begin to fail. While many amphibians, reptiles (for example, snapping turtle), and fish are known to use these reservoirs, it is unknown how exactly the presence of these habitats changed the hydrology and prairie stream network, but likely that the constructed ponds have bolstered lentic habitat at the sacrifice of lotic habitat.

Springs, a groundwater dependent ecosystem, in the pine savanna units are a prominent ecological feature on the landscape in that, similar to streams, they are green lush and diverse areas in an otherwise arid landscape. There are 1,288 stock tanks, which are springs that have been developed for the purpose of watering livestock where the spring water is diverted to a tank. The tanks are often immediately adjacent to the spring. Those spring areas without fencing, can lead to resource damage from trampling and associated soil compaction.

Glaciers

Alpine and rock glaciers are found in several high elevation locations across the greater Yellowstone area of the Custer Gallatin National Forest. Glaciers provide an important source of meltwater in the late summer months when typically most of the annual winter snowfall has melted. Late summer melt from glaciers provides important habitat for trout and other wildlife as well as a water source for drinking and recreation for the surrounding towns and people in the region. Glacial meltwater is an important habitat component for cold-water aquatic species such as cutthroat trout and various macroinvertebrates.

Glaciers are large flowing masses of ice formed by the compaction and recrystallization of snow. For purposes of this analysis, glaciers, and perennial snowfields are not differentiated, as this would require site-specific field evaluation of each location. In the Absaroka Beartooth Mountains there are 401 glaciers and perennial snowfields, about 35 percent of the total number in Montana, and totaling 20 square kilometers (Fountain 2011). The Crazy Mountains contain 57 glaciers and perennial snowfields, representing 5% of the population in Montana, and totaling 1.9 square kilometers (Fountain, 2006 and 2011). Glaciers can be connected to or transition into debris-covered rock glaciers.

Rock glaciers are tongue-shaped flowing masses of ice, rock, and debris often found just downslope of glaciers. Rock glaciers contain significant amounts of water stored as ice and also provides late summer meltwater sources (Price et al. 2013, Rangecroft et al. 2015, Geiger et al. 2018). Surface debris atop rock glaciers serves as an insulator that makes rock glaciers less sensitive to climatic fluctuations when compared to ice glaciers (Price et al. 2013, Sorg et al. 2015). In a scenario of warming climate, rock glaciers may persist and provide hydrologic input longer than ice glaciers.

In the northern Absaroka and Beartooth Mountain ranges, there are approximately 660 rock glaciers with a total 73 km2 area (Seligman 2009). Approximately 15 rock glaciers have been mapped in the Spanish Peaks area (Vuke 2013). Mapping and assessment of rock glaciers in other portions of the Custer Gallatin have not been completed, but it is likely that additional areas of rock glaciers are present across higher elevation portions of the national forest.

Riparian Ecosystems

Riparian ecosystems are comprised of riparian areas and adjacent corridors. Riparian areas are lands at the interface between land and waterbodies saturated with water all year or for varying periods of time during the year. They encompass unique and diverse vegetation types that are closely associated with streams and rivers, lakes, ponds, marshes, swamps, bogs, fens, and other areas of high or fluctuating water tables. Riparian corridors are dominated by non-riparian vegetation types, such as trees (Douglas-fir, Engelmann spruce) and dry grasses. Riparian corridors provide important inputs into the overall ecosystem such as shade for aquatic habitats, and organic matter (for example, leaves) and large woody debris that is critical for aquatic organisms. Although riparian areas and corridors may occupy a small percentage of the landscape, they provide important habitat for many terrestrial and aquatic species, including connectivity of habitat from headwaters to downstream areas.

About 77,540 National Forest System acres of riparian areas and corridors associated with these aquatic features comprise about 4 percent of the montane units and 1 percent of the pine savanna units. Table 15 displays the acres of riparian areas and corridors by vegetation dominance types, by geographic area.

Of that, nearly 30,000 acres contain riparian and wetland obligate vegetation types: riparian graminoid (grass and grass-like; about 19,700 acres), riparian deciduous tree (cottonwood, aspen, green ash; about 7,900 acres), and riparian shrub types (about 2,400 acres). The remaining 92,850-plus acres are dominated by non-riparian vegetation types, such as Douglas-fir, Engelmann spruce, and dry grasses. This is likely a slight underrepresentation of montane riparian vegetation as there are some data gaps in the central portion of the Madison, Gallatin, Henrys Lake geographic areas and the Absaroka Beartooth Mountain geographic area. At long-term monitoring sites, within grazing allotments, 484 plant species have been documented.

Natural disturbances that historically influenced the forests within riparian areas are floods, fire, insects, disease, and weather events such as windstorms and blowdown. These effects cause varying amounts and extents of tree mortality, from nearly all trees killed (such as in a mountain pine beetle epidemic in a lodgepole pine-dominated stand) to only scattered trees killed. Forest structure is affected, including changes to and decreases in forest density and canopy closure and increased amounts of dead wood. Reduced canopy closure may stimulate growth of understory grasses, forbs, and shrubs as well as improve growth on remaining live trees. Tree species compositions may change.

Table 15. Riparian vegetation dominance types and National Forest System acreage by geographic area

Geographic Area (GA)	Aspen (acres)	Cotton-wood Green Ash[1] (acres)	Graminoid [2] (acres)	Shrub (acres)	Riparian Vegetation (acres)	Riparian Corridor (acres)[3]	Total Riparian Ecosystem (acres)	% Riparian by GA
Madison, Gallatin, Henrys	4,932	318	18,393	1,823	25,466	24,297	49,763	6
Absaroka Beartooth Mtns	3,717	227	6,160	672	10,776	24,571	35,347	3
Bridger, Bangtail, Crazy Mtns	924	7	767	338	2,036	3,429	5,465	3
Pryor Mtns	40	2	11	109	163	2115	2,278	3
Montane	5,896	544	25,331	2,942	38,441	54,412	92,853	4
Sioux	Trace[1]	744	458	56	1,259	NA	1,259	1
Ashland	Trace[1]	38	732	73	843	NA	843	<1
Pine Savanna	Trace	782	1,190	129	2,102	NA	2,102	<1
Grand Total	NA[4]	NA	NA	NA	29,767	NA	77,540	3

1. Aspen and cottonwood are present on the pine savanna units, usually within green ash dominant riparian, but are not the dominant species; green ash is only present on pine savanna units.
2. Moist site grass and grass-like vegetation (for example, sedges).
3. Non-riparian vegetation dominates but riparian processes still at play (such as, conifers dominate, but within recruitment zone of stream channel). Typical vegetation types: Douglas fir, Engelmann spruce, lodgepole pine, dry site grasses.
NA = not applicable

Riparian Management Zones

Riparian management zones are areas where riparian-dependent resources receive primary emphasis and management activities are subject to specific standards and guidelines. These areas consist of riparian and upland vegetation adjacent to streams, wetlands, and other bodies of water and help maintain the integrity of aquatic ecosystems by influencing the delivery of coarse sediment, organic matter, and woody debris to streams; providing root strength for channel stability; shading the stream;

and protecting water quality (Naiman et al. 1992). Fish, other aquatic life, and wildlife benefit greatly from riparian area protection due to these functions.

Upland vegetation within riparian management zones in combination with the riparian vegetation create zones that provide important wildlife habitat and connectivity. Most wildlife use riparian management zones and aquatic habitats for at least some of their daily or seasonal needs. Due to their widespread distribution and linear or clustered pattern, riparian management zones provide extensive and important habitat connectivity areas for numerous species of wildlife. Refer to wildlife section for information on riparian-associated wildlife species and connectivity of habitat.

During the past few decades, land managers have recognized the importance of riparian ecosystems in maintaining water quality, terrestrial habitat, and aquatic habitat. As a result, riparian conservation measures have been developed for Federal, state, and private lands—helping to preserve and protect the integrity of the riparian and wetland habitats as well as the water quality of associated waterbodies. On National Forest System lands, site-specific standards and guidelines are applied to riparian management zones, helping to provide connectivity and maintain composition, structure, and function. Riparian area protections were included in the 1986 and 1987 forest plans.

The Custer Gallatin National Forest is more arid than units west of the Continental Divide, a fact that strongly influences vegetative productivity overall (Pfister et al. 1977a). This same dynamic is foremost in relevance to riparian management, because it results in generally smaller site potential trees (verified by Custer Gallatin, unpublished data) within and adjacent to riparian areas, likely smaller channel and floodplain widths, and reduced riparian vegetation expression. When site potential trees are used as an indicator to define riparian zone widths, the smaller site potential trees of the Custer Gallatin would result in a narrower riparian management zone widths than forests west of the Continental Divide.

Aquatic Species and Habitat

Thirty-six species of fish (21 native; table 16) are known (or suspected, in some cases) to occupy approximately 2,880 miles of stream, and 565 lakes (includes lakes, ponds, and reservoirs). The montane units have cold water species like trout, while the pine savanna units have warm water fish species. Occupied stream miles are likely much higher because fish distribution hasn’t been verified for many streams, particularly alpine and pine savanna streams. As fish distribution is verified, species composition is also likely to change, particularly in pine savanna and lower elevation montane streams, where fewer surveys have been conducted, but where species diversity is higher. Across the Custer Gallatin, aquatic macroinvertebrates occur in great abundance and diversity and are important indicators of bio-integrity. Currently there are 349 species of aquatic invertebrates known to occur on the Custer Gallatin. As inventories continue, that composition is also likely to change. Amphibians and reptiles are also present in waterbodies and riparian areas across the Custer Gallatin National Forest increasing the overall biodiversity. Amphibians are often associated with or even dependent on water and riparian areas while most reptiles, save for snapping and painted turtles, are not water or riparian obligates yet many are often present in and benefit from aquatic and riparian resources.

Aquatic invasive species are a substantial threat to aquatic species and include any non-native plant or animal species or disease that threatens the diversity or abundance of native species, the ecological stability of infested waters, or the commercial, agricultural, or recreational activities dependent on such waters. The Montana Aquatic Nuisance Technical Committee (MTANSTC 2002) has identified over 70 nuisance species while South Dakota Fish and Game has identified 24 nuisance species (Adams et al.

2016). Some that are well known include the New Zealand mud-snail, curly-leaf pondweed, whirling disease, rusty crayfish, and various non-native fish. Although non-native fish such as brook trout and rainbow trout are desirable in many locations, there are places where they are not due to their ability to outcompete or hybridize with native cutthroat. An environmental assessment by the Montana Fish Wildlife and Parks is now required before fish introductions can legally occur.

Table 16 displays fish species of the Custer Gallatin National Forest. Stream miles indicated estimate occupied habitat on the national forest. An "incomplete survey" comment indicates distribution is likely more extensive than indicated, given knowledge of available habitat types.

Table 16. Fish species of the Custer Gallatin National Forest

Fish Species	Montane (stream miles)	Pine Savanna (stream miles)	Total (stream miles)	Status	Comments
Arctic grayling	28	0	28	SGCN - MT	Stream miles linked to occupied Montane lakes
Black bullhead	0	26	26	Introduced	Also in some Pine Savanna impoundments
Black crappie	0	0	0	Introduced	Pine Savanna impoundments
Brassy minnow	0	92	92	Native	None
Brook stickleback	0	1	1	Native	Incomplete survey
Brook trout	717	1	718	Introduced	None
Brown trout	384	0	384	Introduced	None
Creek chub	0	1	1	Native	Estimated based on adjacent records
Fathead minnow	0	63	63	Native	None
Flathead chub	0	8	8	Native	Estimated based on adjacent records
Golden shiner	0	0	0	Introduced	Pine Savanna impoundments
Golden trout	34	0	34	Introduced	Stream miles linked to occupied Montane lakes
Green sunfish	0	20	20	Introduced	Larger stream pools, impoundments; most widely distributed Pine Savanna invasive fish
Iowa darter	0	3	3	SGCN - MT	Incomplete survey; confirmed in both MT and SD
Lake chub	0	113	113	SGCN - SD	Confirmed in SD - Grand River tributary on Forest; also present downstream of Forest Boundary in several Montane HUCs
Lake trout	0	0	0	Introduced	Montane lakes
Largemouth bass	0	0	0	Introduced	Pine Savanna impoundments
Longnose dace	19	98	117	Native	None
Longnose sucker	66	0	66	Native	None
Mottled sculpin	419	0	419	Native	Also known as Rocky Mountain Sculpin
Mountain sucker	43	0	43	Native	None
Mountain whitefish	206	0	206	Native	None
Plains minnow	0	7	7	Native	None

Fish Species	Montane (stream miles)	Pine Savanna (stream miles)	Total (stream miles)	Status	Comments
Pumpkinseed	0	1	1	Introduced	Otter Creek
Rainbow trout	706	0	706	Introduced	Also stocked in Pine Savanna impoundments
River carpsucker	0	0	0	Native	Found at Boxelder Cr FS Road crossing
Sand shiner	0	1	1	Native	Estimated based on adjacent records
Sauger	0	0	0	SGCN - MT	Found at Boxelder Creek FS Road crossing
Shorthead redhorse	0	11	11	Native	None
Smallmouth bass	0	1	1	Introduced	Stocker Branch, Blacks Pond
Stonecat	0	8	8	Native	None
Utah chub	6	0	6	Introduced	Hebgen, Mystic Lakes
Westlope cutthroat	213	0	213	SGCN – MT	None
White sucker	87	560	646	Native	None
Yellow perch	0	0	0	Introduced	Pine Savanna ponds (such as, Exie)
Yellowstone cutthroat	694	0	694	SGCN - MT	None

SGCN-MT= Species of greatest conservation need in Montana

On the Custer Gallatin, westslope and Yellowstone cutthroat trout historically likely occupied 949 and 758 stream miles, respectively. In the Missouri River basin, westslope cutthroat are far less common than their rangewide occupancy: the current Custer Gallatin westslope cutthroat distribution constitutes 9 percent of total habitat occupied by the subspecies in the Madison, Gallatin, and upper Missouri River watershed. The Custer Gallatin includes 34 percent of overall occupied cutthroat habitat in the major watersheds intersecting the national forest (Madison, Gallatin, and Yellowstone).

The distribution of non-native salmonids is a primary reason for the reduced range of cutthroat trout. Rainbow and brook trout are the most widely distributed salmonids on the Custer Gallatin, and these species, along with brown trout, may replace, displace, or hybridize native cutthroat (summarized in table 17 and table 18) (Halfosky et al. 2016). As such, the Custer Gallatin and partners have built fish passage barriers to protect native trout from non-native trout. In conjunction with fish barrier construction or natural barrier enhancement, non-native trout are also removed chemically or physically from above the barrier site. Of the total mileage occupied by the cutthroat subspecies on the Custer Gallatin, about 73 miles of stream habitat has been secured for westslope cutthroat trout (83 percent of westslope cutthroat trout occupied stream miles) and 78 miles for Yellowstone cutthroat (22 percent of Yellowstone cutthroat miles) over the past decade. Cutthroat conservation will continue to be a priority for the Custer Gallatin, as Montana Fish Wildlife and Parks has set the goal for cutthroat conservation at a minimum of 20 percent cutthroat occupancy in historically occupied watersheds (Montana Fish Wildlife and Parks 2014).

Table 17. Cutthroat trout habitat occupancy on the Custer Gallatin National Forest

Custer Gallatin Habitat	Yellowstone Cutthroat Trout	Westslope Cutthroat Trout
Historic occupied stream habitat (miles)	758	949
Current occupied stream habitat (miles)	352	88
Historic habitat currently occupied by core/ conservation populations (%)	46	9
Current populations in sympatry with Brook trout (%)[1]	28	0

1. Sympatry with brook trout is a measure of competition risk

Note: Secured means nonnatives removed, and precluded from reinvasion by a barrier

Table 18. Cutthroat trout habitat occupancy rangewide

Rangewide Habitat	Yellowstone Cutthroat Trout	Westslope Cutthroat Trout
Historic range-wide habitat currently occupied (%)	43	59
Populations occupying historic habitat considered not likely hybridized (%)[1]	23	15

1. Hybridization can compromise conservation value of populations

Many montane lentic habitats, as well as some of the montane lotic habitats provide breeding and rearing habitat for western toads (*Anaxyrus boreas*). Western toads are relatively common in some portions of the Custer Gallatin, particularly Hebgen Lake and north in the Madison mountain range (Maxell 2009) The Crazy Mountains and Beartooth Plateau are areas for which additional data are needed to assess species status; the species is considered vulnerable to population crashes, as has happened in other places within its distribution (Maxell et al. 2009). Hebgen Reservoir and adjacent littoral ponds provide breeding and rearing habitat for plains spadefoot (*Spea bombifrons*), a species of greatest conservation need more commonly found in pine savanna locales. Another amphibian species, northern leopard frog (*Lithobates pipiens*), is also a species of greatest conservation need. This species has not been documented on montane portions of the Custer Gallatin since 1961, in East Rosebud Lake (MNHP, 2016). However, it is quite common in the Northern Great Plains of eastern Montana and the western North and South Dakotas, including the Ashland and Sioux geographic areas. The western tiger salamander (*Ambystoma mavortium*) is known to occur in montane and pine savanna areas east of the Continental Divide but is particularly abundant in ponds and intermittent streams of the pine savanna units of the Ashland and Sioux.

A native mussel the Fatmucket mussel (*Lampsilis siliquoidea*) could use habitat in the pine savanna geographic area. They can be found under a number of conditions but prefer sandy-muddy bottoms and shallow (5 to 8 centimeters) quiet water below riffles, and in slowly running water with sand, fine gravel, and mud. Another native mussel, the giant floater (*Pyganodon grandis*) also may be present here and is known to be very abundant in the Little Missouri River system. Also, it can be found in smaller intermittent prairie streams if permanent pools are present as occurs in the pine savanna geographic areas.

Aquatic Forest Service Sensitive Species

Forest Service sensitive species are defined as “plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by: significant current or predicted downward trends in population numbers or density; or significant current or predicted downward trends in habitat capability that would reduce a species’ existing distribution.” The current Northern Region sensitive animal species list was developed in 2011. Suitable habitat for nine currently listed Forest Service sensitive aquatic (fish, amphibian, and mussel) species exists on the Custer Gallatin National Forest. Seven of the nine species have known populations that occur on the national forest while two species are not known to occur or likely no longer occur.

Upon final Regional Forester’s determination of the Custer Gallatin’s Aquatic Species of Conservation Concern list, the Regional Forester’s sensitive aquatic species list will be replaced with the species of conservation concern list. Analysis of sensitive aquatic species pertain to the current forest plans. Appendix C provides the Regional Forester’s sensitive species list.

Federally Listed (Proposed Threatened) Aquatic Species: Western Glacier Stonefly

The western glacier stonefly (*Zapada glacier*) is an aquatic macroinvertebrate known to occur in alpine streams. It is currently listed as “Proposed: Threatened” under the Endangered Species Act (Federal Regulation, 2017). The most robust data for this species comes from Glacier National Park where the species was first described in 1971, from specimens collected and preserved from 1963-1969 (Giersch et al. 2015). This species appears to be most often found in outlets of alpine lakes, streams draining glaciers, and streams draining from semi-permanent snowfields. In Glacier National Park the documented decrease in the size of glaciers (Hall and Fagre 2003) among other effects of climate change, such as decreased annual snowpack, are linked to declining habitat and persistence of the western glacier stonefly and other rare invertebrates in alpine habitats (Muhlfeld et al. 2011, Giersch et al. 2016).

Western glacier stonefly has been documented in the Absaroka Beartooth Mountains geographic area (in high alpine designated wilderness). It is likely based on confirmed locations that the western glacier stonefly may be more abundant on the Custer Gallatin National Forest than previously thought with more potential habitat available in Absaroka Beartooth Mountains, Gallatin Mountains and Henrys Lake, and the Bridger, Bangtail, and Crazy Mountain Geographic Areas.

Western glacier stonefly nymphs (immature stage of aquatic macroinvertebrates residing in aquatic habitats before emerging from the water as sexually mature adults) cannot be identified by hand and instead require genetic analysis, making the time to determine distribution costly. Additionally, their very remote habitat, seasonally limited access, and lengthy treks to potential sites make sampling even more difficult if not inefficient. Researchers are planning to use eDNA technology in the future (if funding becomes available) to expedite the process of determining presence or absence and more detailed habitat requirements (Joe Giersch, USGS researcher, personal communication).

Aquatic Species of Conservation Concern: Western Pearlshell

The western pearlshell (*Margaritifera falcata*) is the only native mussel found in the montane portion of the Custer Gallatin National Forest. Montana Fish Wildlife and Parks listed this species as a “Species of Concern” “and the Regional Forester has identified it as a species of conservation concern on the Custer Gallatin. Stagliano (2015) found this species declining by approximately 20 percent over the last decade in Montana. Its range extends throughout the western United States and Canada where it is declining, and even extirpated in some locations. In Montana it is almost certainly extirpated from rivers such as the Bitterroot, Big Hole, Clark Fork, and the Blackfoot. On the Custer Gallatin National Forest is likely the historical distribution of the pearlshell closely matched the historical distribution of the westslope cutthroat.

This species tends to inhabit the runs and riffles of colder streams and rivers that have a stable gravel substrate with a low to moderate gradient wider than 2m. The western pearlshell is intolerant to silt and warming stream temperatures. It is dependent on a host fish species, like most other mussels, during its parastic larval stage. Glochidia (microscopic larval stage of freshwater mussels) attach to the gills of the host fish where they can be transported upstream or downstream. For the Custer Gallatin, and throughout Montana, that fish species is the westslope cutthroat trout. As such, widespread decline in westslope cutthroat has a negative impact on the western pearlshell, since the historical distribution of the pearlshell closely matched the historical distribution of the westslope cutthroat. Once they detach form the host fish species and become adults they are sedentary not moving more than a few meters where they filter feed consuming plant and animal organic matter and expel water, hence the need for clean, silt-free, water. They tend to congregate in boulder protected “beds” and if undisturbed are known to have lengthy life spans. MNHP (2018) demonstrated the western pearlshell can have a lifespan in excess of 60 years.

Benefits to People

Aquatic and riparian ecosystems on the Custer Gallatin support a wide variety of direct human uses and benefits, although many of these uses may impair ecosystem function if not properly managed. Among these are angling and other forms of recreation, municipal and residential water supply, and agricultural uses (stock water, irrigation). In addition, these ecosystems provide a variety of additional benefits, such as flow modulation (buffering both flood and base flows), water filtration, erosion control, groundwater recharge, wildlife habitat and migration corridors, and scenery. National forest watersheds moderate both high and low flows through the function of floodplains and wetlands. Water storage and retention in national forest floodplains can both reduce the rate and duration of peak flow response, but also assist in retaining base flows. These processes can be amplified by beaver colonies.

Source Water Protection Areas and Municipal Watersheds

Public water systems are defined under the Safe Drinking Water Act as entities that provide “water for human consumption through pipes or other constructed conveyances to at least 15 service connections or serves an average of at least 25 people for at least 60 days a year” (U.S. Environmental Protection Agency 2017). The term “public” in “public water system” refers to the people drinking the water, not to the ownership of the system.

Source water protection areas are established to protect public water systems from contamination in accordance with the 1996 amendments to the Safe Drinking Water Act. Montana Department of Environmental Quality’s source water protection program provides guidance and approval of source water protection areas within the state of Montana. Source water protection areas in Montana are divided into distinct regions according to the time water takes to reach a public water system intake. The purpose of subdividing source water protection areas in this way is to prioritize source water protection efforts. Montana Department of Environmental Quality has identified management goals within each of these regions, and these management goals are discussed in the context of the water systems located within, adjacent to, or downstream of the Custer Gallatin National Forest.

Public water system intakes on surface water, for example, streams, are the most susceptible to contamination from land management activities within the Custer Gallatin National Forest. One public water system diverts surface water within the Custer Gallatin. The city of Bozeman diverts water out of Hyalite Creek from within the Custer Gallatin National Forest in the northern Gallatin Mountains. In addition, the city of Bozeman also diverts surface water out of Sourdough Creek, but this diversion is located outside of the national forest. The source water protection areas of all surface water intakes includes a “spill response” area that is a buffer along each source stream measuring a maximum of 10 miles in length, 0.5 mile from both streambanks and 0.5 mile downstream from the surface water intake, confined to the extent within the contributing watershed. These spill response areas are to be managed to prevent releases of contaminants that could be drawn directly into a water intake with little lag time. In addition, the rest of the contributing watershed upstream of the intake is the “watershed region” part of the source water protection area, in which management is to maintain and improve the quality, in the long term, of surface water used by the public water system (MT DEQ, 1999, Montana Source Water Protection Program, Montana Dept. of Environmental Quality, November 1999).

In addition to the city of Bozeman, the Christikon Bible Camp also has a spill response region that intersects the Custer Gallatin, and another 17 surface water users located downstream of the national forest have a “watershed region” source water protection area that extends up into the national forest. These 17 surface water public water systems serve approximately 262,581 people (table 19 and table 20).

Groundwater sources also supply drinking water on the Custer Gallatin. There are 30 public water systems withdrawing groundwater within National Forest System lands on the Custer Gallatin. These groundwater systems are serving approximately 11,433 people. Montana’s source water protection program states that areas located within 100 feet of these groundwater sources is the control zone for each intake, and this area is to be managed to protect sources from damage and to prevent direct introduction of contaminants into sources or the immediate surrounding areas. Table 21and table 22 provide the information for the 3 community and 27 non-community public water systems that have wells or spring water sources located within National Forest System lands. There are four additional public water systems that use groundwater within close proximity to the on the Custer Gallatin and have 100-foot control zones that intersect National Forest System lands. These public water systems are found in table 21.

Table 19. Public water systems (PWS) that use surface water and have spill response regions that overlap the Custer Gallatin

PWS number	PWS Primary Name	Water Source	Class of PWS per the Safe Drinking Water Act	Population served by PWS
MT0000161	City of Bozeman	Hyalite Creek and Sourdough Creek	Community	50,000
MT0001548	Christikon Bible Camp	Boulder River	Non community	100

Table 20. Public water systems (PWS) that use surface water with intakes located downstream of National Forest System lands with source water protection areas whose watershed region overlaps National Forest System lands within the Custer Gallatin National Forest

PWS number	PWS Primary Name	Water Source	Class of PWS per the Safe Drinking Water Act	Population served by PWS
MT0000153	City of Billings	Yellowstone River	Community	114,,000
MT0000156	Lockwood WUA	Yellowstone River	Community	5900
MT0000192	Town of Culbertson	Missouri River	Community	1,700
MT0000215	City of Forsyth	Yellowstone River	Community	1,944
MT0000218	Town of Fort Peck	Fort Peck Lake	Community	240
MT0000229	City of Glendive	Yellowstone River	Community	5,500
MT0000235	City of Hardin	Big Horn River	Community	3,500
MT0000270	City of Laurel	Yellowstone River	Community	6,339
MT0000290	Town of Melstone	Musselshell River	Community	170
MT0000291	City of Miles City	Yellowstone River	Community	8,800
MT0000415	City of Glasgow	Missouri River	Community	3,253
MT0000416	Montana Aviation Research Co	Missouri River	Community	62
MT0000525	City of Great Falls	Missouri River	Community	60,000
MT0000103	Yellowtail Dam Powerplant and Visitor Center	Yellowtail Reservoir	Non community	48
MT0003448	Rock Creek Marina and Campground	Ft Peck Reservoir	Non community	50
MT0042450	Hell Creek State Park	Fort Peck Reservoir	Non community	50
MT0003326	Montana Dakota Utilities Co	Yellowstone River	Non transient Non community	25

Table 21. Community public water systems (PWS) that use groundwater wells/spring water sources located within National Forest System lands

PWS Number	PWS Primary Name	Place Name	Population served by PWS
MT0062294	Soda Butte Campground	Bozeman	40
MT0062303	Red Cliff Campground	Bozeman	70
MT0062306	Madison Slide Visitor Center	Bozeman	500
MT0062307	Rainbow Point Campground	Bozeman	100
MT0062479	Fairy Lake Campground	Bozeman	30
MT0063649	Lonesome Hurst Campground	Bozeman	40
MT0062299	Hood Creek Campground	Bozeman	30
MT0000331	Silver Gate Water Association Inc.	Cooke City	40
MT0001546	Cinnamon Lodge And Adventures	Gallatin Gateway	76
MT0062579	Pine Creek Campground	Livingston	47
MT0001687	Camp Mimanagish	McLeod	50
MT0002042	Templed Hills Baptist Camp	Pray	40
MT0002505	Red Lodge Mtn Midway Lodge	Red Lodge	150
MT0002906	Yellowstone Presbytery	Red Lodge	30
MT0062224	Limber Pine Campground	Red Lodge	40
MT0062227	Greenough Lake Cg	Red Lodge	50
MT0062228	Parkside Campground	Red Lodge	40
MT0062235	Basin Campground	Red Lodge	50
MT0062237	Emerald Lake Campground	Red Lodge	30
MT0062577	Beartooth Mountain Youth Camp	Red Lodge	75
MT0002507	Timbercrest Girl Scout Camp	Red Lodge	50
MT0062234	Woodbine Campground	Red Lodge	102
MT0001341	Happy Hour Bar And Lakeview Condos	West Yellowstone	58
MT0001349	Campfire Lodge Resort Inc.	West Yellowstone	104
MT0001818	Madison Arm Resort	West Yellowstone	107
MT0062309	Beaver Creek Campground	West Yellowstone	60
MT0003894	Stillwater East Boulder*	Big Timber	380

*This PWS also classified as non-transient.

Table 22. Public water systems (PWS) that use ground water in close proximity to the Custer Gallatin National Forest and have control zones that overlap the Custer Gallatin

PWS Number	PWS Primary Name	Place Name	Class of PWS per the Safe Drinking Water Act	Population served by PWS
MT0001251	Deer Park Chalet	Bozeman	Non community	1,500
MT0003755	Sphinx Mountain Mb Hm Pk	Gardiner	Community	52
MT0004065	Lakeview Suites	Hebgen Lake	Non community	38
MT0062308	Bakers Hole Cg	Bozeman	Non community	82

In addition to the control zone, the area within 1 mile of each groundwater public water system sources are typically designated as inventory regions by Montana Department of Environmental Quality (MTDEQ), which are managed to minimize susceptibility to contamination. The inventory region encompasses the area expected to contribute water to a public water system within a fixed distance or a specified groundwater travel time. The recharge region is generally the entire area contributing recharge to groundwater that may flow to a drinking water supply over long time periods or under higher rates of usage. The delineation of these inventory regions can be defined using other methodologies than a simple one-mile buffer, depending on the information available and the circumstances. Management in these inventory regions will be focused on pollution prevention activities where water is likely to flow to a public water system well intake within a specified time period. These inventory regions have various degrees of delineation on the Custer Gallatin, and management in these inventory regions will be considered at the site-specific project level. Best management practices can be implemented to control non-point sources of contamination in these areas (MTDEQ, 1999). These public water systems are listed in table 21 and table 22.

Although all water that originates on the Custer Gallatin National Forest could be used for municipal supply at some point downstream, Forest Service Manual 2542.03 states “identify watersheds providing the principal source of community water during land management planning.” As such, municipal watersheds are specific subset of watersheds that typically receive additional consideration and protection from land management actions on National Forest System lands. Watershed protection direction is provided for municipal supply watersheds in Forest Service Handbook 2509.22. As stated in 36 CFR 251.9(a), “The Forest Service shall manage national forest watersheds that supply municipal water under multiple use prescriptions in forest plans (36 CFR, part 219).” It continues that in order for a municipality to receive additional protection measures beyond those already specified in the forest plan, agreements, and special-use authorizations, a “municipality must apply to the Forest Service for consideration of these needs.”

The Custer Gallatin has five municipal supply watersheds recognized in accordance with 36 CFR 251.9 (table 23). Whiskey Spring originates to the south of the city of West Yellowstone and flows into the south fork of the Madison River. There is a water intake for the city that is derived from a spring, directly from the ground. There have been ongoing discussions with the Forest Service and city personnel on the topic of additional municipal water sources for West Yellowstone as there is concern Whiskey Spring, and a groundwater well being developed in town, will not provide enough water in the near future.

Hyalite Creek and Sourdough Creek originate south of the city of Bozeman and flow north through town to the East Fork of the Gallatin River. Lyman Spring originates in the east end of the Bridger Mountains flowing for less than a mile on Forest Service lands, north of the city of the Bozeman, and flows south into Bridger Creek which eventually drains to the East Fork Gallatin River. Lyman spring municipal water is considered groundwater diverted through spring-boxes. Sourdough, Hyalite, and Lyman supply about 40 percent, 40 percent, 20 percent, respectively, of Bozeman City Water Supply with other off-Forest (primarily groundwater wells in the valley) private water supply systems also supplying water to some users. Whiskey Spring originates to the south of the city of West Yellowstone and flows into the south fork of the Madison River. There is a water intake for the city that is derived from a spring, directly from the ground. There have been ongoing discussions with the Forest Service and city personnel on the topic of additional municipal water sources for West Yellowstone as there is concern Whiskey Spring, and a groundwater well being developed in town, will not provide enough water in the near future.

Table 23. Municipal watersheds of the Custer Gallatin National Forest (CGNF)

User	Source Water	User Type	Population	Acres of CGNF in source watershed	Total acres of source watershed
City of Bozeman	Bozeman Creek	Community	50,000	14,926	18,747
City of Bozeman	Hyalite Creek	Community	50,000	31,045	31,355
City of Bozeman	Lyman Creek*	Community	50,000	5,895	8,405
City of Red Lodge	West Fork Rock Creek*	Community	2,237	18,047	18,967
City of West Yellowstone	Whiskey Spring (South Fork Madison River) *	Community	1,365	15,365	15,933

*Current water drawn from groundwater wells

In addition, 5,410 private water rights are held on points of diversion on the Custer Gallatin; some of these are for residential use, and others are for agricultural purposes (table 24).

Table 24. Number of water rights held on the Custer Gallatin National Forest

Water Rights	Total	Domestic Use	Irrigation	Commercial	Lawn & Garden	Geothermal	Fish & Wildlife
Number of water rights	5,410	2,058	1,183	250	511	4	194

More than half of Montanans and South Dakotans depend on groundwater for their primary water supply (Maupin et al. 2014). However, the current withdrawal in Montana represents a small percent of the available groundwater recognizing that the amount of available groundwater far exceeds that of available surface water. Groundwater provides 94 percent of Montana's rural domestic water supply and 39 percent of the public water supply. Montana uses over 188 million gallons of groundwater per day for domestic use, public water supplies, irrigation, livestock, and industry uses (USGS, 2010). Water generated in the mountains and hills of the Custer Gallatin is an important source of recharge for valley aquifers and is therefore an important ecosystem service provided by the national forest. Demand for water will likely increase in importance with an increasing population, increasing demand for aquatic and riparian resources, and potential effects of climate change on these resources (LeRoy Poff et al. 2012).

Angling

As of 2009, angling on just the five most-fished Custer Gallatin waterbodies (Madison, Gallatin, and Yellowstone Rivers; Hebgen and Hyalite Reservoirs) was over 146,000 angler days, with 45 percent of these angler days representing nonresident fishermen (MFISH 2016). These numbers don't account for the secondary benefits of high quality water, forage, and fish produced on the Custer Gallatin that support mainstem fishing on segments of those streams and others downstream of the national forest boundary. The portion of Madison River downstream of the Custer Gallatin alone supports nearly 121,000 angler days a year, whereas the Yellowstone has over 71,000 angler days.

In addition to these nationally and internationally known fisheries, the Custer Gallatin supports diverse locally and regionally important angling opportunities. Among these are high mountain lakes, where species like golden and lake trout, and Arctic grayling are destination fisheries for some anglers, and pine savanna reservoirs, where largemouth and smallmouth bass, panfish, and put-and-take rainbow trout are targeted species. Overall, National Visitor Use Monitoring data show that 4.9 percent of Custer Gallatin visitors came to the national forest for the primary purpose of fishing, whereas 8.2 percent of all visitors annually fished (254,000 of the Custer Gallatin's annual visitation of about 3.1 million people). Impacts to fisheries from angling, and the practice of fish stocking, is under the management of state fish and game agencies. The pine savanna units have several warm-water sport-fish ponds, which while they are not nationally recognized, provide angling opportunities primarily for locals.

3.4.3 Environmental Consequences

Current Plans

Management Direction under the Current Plans

The 1987 Gallatin and 1986 Custer National Forest Plans, as amended, include the following forestwide goals, paraphrased as: ensure water resources are in desirable condition, water quality will be maintained at a level that meets or exceeds state water standards, and will remain so into the future.

The 1987 Gallatin Forest Plan, as amended, includes the following forest-wide goal: manage and restore aquatic habitats to sustain fully functioning aquatic ecological systems and native species diversity, as determined by the suitability and capability of those systems, and to meet aquatic management goals of Montana Fish Wildlife and Parks, other agencies, and state water quality standards. The 1986 Custer Forest Plan, as amended, includes the following forest-wide goal: the goal of wildlife and fisheries management is to manage and/or improve key wildlife and fisheries habitats, to enhance habitat quality and diversity, and to provide wildlife and fish-oriented recreational opportunities. Most of the critical habitat areas have been incorporated into management areas that maintain or improve these key habitats. Wildlife and fisheries management is considered in all management areas and the level of wildlife habitat will increase over time.

The 1987 Gallatin and 1986 Custer Forest Plans have components that benefit riparian ecosystems. Direction, paraphrased, includes considering utilization levels of livestock in riparian areas and management of timber in riparian areas will be designed to maintain or improve fish habitat. A standard in the Custer Forest Plan stated riparian vegetation would be managed along all perennial streams with defined channels to provide shade, to maintain stream bank stability and in-stream cover, and to promote filtering of overland flows.

Effects of the Current Plans

The Custer Gallatin National Forest is expected to continue improving, enhancing, and maintaining native, and desired non-native aquatic species and their habitat primarily in montane habitats under the direction of the current forest plans. Less direct conservation work has occurred in the pine savanna units, and that would be expected to continue, which is the result of lack of quality data and understanding of prairie aquatic biota species and habitat needs.

Conditions that support sensitive species' population viability are expected to remain stable for all sensitive species on the Custer Gallatin with these plan components. However, climate change and exotic species, such as non-native fish have a high potential for deleterious effects to sensitive species. Habitat quality has the potential to improve, however there are fewer plan components promoting restoration and protection relative to the revised plan alternatives. The current plans are expected to maintain similar habitat quality for sensitive aquatic animal species in all habitat guilds.

The Custer Gallatin National Forest is expected to continue to maintain or restore riparian areas, but the language in the current plan is ambiguous leaving room for riparian areas to be negatively impacted by various land-uses, which is the current state in isolated situations.

There is a history of permitted mining operations on the Custer Gallatin that occurred before the 1987 Gallatin and 1986 Custer Forest Plans, but much cleanup efforts occurred during the life of those plans and would be expected to continue. The McLaren Mine operation started in the 1870s near Cooke City in the Absaroka Beartooth geographic area. The historic effects of the mine negatively impacted water quality in Soda Butte Creek. Through large investments in reclamation and rehabilitation, Soda Butte Creek water quality was dramatically improved (Henderson et al. 2018). Soda Butte Creek is now slated to be the first stream on the Custer Gallatin to be taken off the 303(d) list of impaired water bodies. The Stillwater mine (palladium and platinum) has been in operation on, and adjacent to the national forest, since 1986 for the Stillwater operation near Nye, Montana and 1999 for the East Boulder operation. Due to a progressive mining operation, a strong partnership with Custer Gallatin, Montana Department of Environmental Quality, the Stillwater mine, and a geologic formations that is not conducive to acid mine drainage. There have been very little impacts to water quality from this large mining operation and that would be expected to continue. An abandoned uranium mine in the North Cave Hills of the Sioux geographic area has had adverse impacts to water quality and stream channels, but massive reclamation have been ongoing and would be expected to continue.

Management under current forest plan direction is increasing the presence of westslope cutthroat trout, which is also beneficial to the western pearlshell because glochidia (microscopic larval stage of freshwater mussels) attach to the gills of the host fish where they can be transported upstream or downstream. For the Custer Gallatin, and throughout Montana, that host fish species is the westslope cutthroat trout (Hovingh 2004, Stagliano 2010). Currently a strong partnership with Montana Fish Wildlife and Parks and other partners fostering conservation projects (and conversion of non-passable culverts to aquatic organism passages on Custer Gallatin Forest roads in high priority cutthroat streams) has led to this trend of increasing presence on the national forest.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

A substantial change between the revised plan alternatives and the current plans is the incorporation of forestwide plan components that, together, provide more detail and clarity regarding the conditions and management of watersheds, drinking water, aquatics, and riparian areas that would contribute to the overall goal of maintaining the integrity and resilience of the watersheds on the Custer Gallatin National Forest.

All revised plan alternatives would emphasize riparian management zones and would facilitate management of multiple ecological goals and long term ecological sustainability on a landscape basis. Revised plan alternatives would emphasize more than just fish bearing streams, which has been a historical focus. Instead, fishless streams and other water bodies, such as wetlands, also have protection which is critical to maintaining the overall ecological integrity of water resources. Non fish bearing streams comprise approximately 70 percent or more of the entire forest stream network, providing inputs of wood, sediment, cool water, nutrients, and invertebrates to downstream reaches (Benda et al. 2002, Wipfli and Gregovich 2002); and provide habitat for headwater amphibians and other biota (Meyer et al. 2007). New aquatic and riparian desired conditions, objectives, standards, and guidelines would be applied in a consistent manner across the entire forest across all revised plan alternatives.

The Conservation Watershed Network (Appendix C of the draft revised plan) provides a network of watersheds designed to emphasize conservation of westslope cutthroat trout, Yellowstone cutthroat trout, prairie fish assemblages, municipal watersheds, and other aquatic biota by protecting and restoring habitat conditions, processes, and landforms that provide quality habitat. The intent for selecting conservation watersheds is to contain the largest intact populations and provide long-term protection to aquatic biota populations across the Custer Gallatin National Forest. All occupied and expected to be occupied cutthroat streams and streams with perennial water and native fish presence in the pine savanna stream were designated conservation watersheds networks.

The revised plan alternatives vary by the level of plan objectives for number of aquatic organism passage devices installed, number of acres or miles of stream habitat improved, number of recreation facilities removed from the riparian management zone, road conditions improved or decommissioned.

Effects Common to the Revised Plan Alternatives

Plan components for aquatic habitat and riparian management zones that have been added to all revised plan alternatives would provide a greater level of protection for aquatic and riparian (including wetlands and other lentic water bodies) resources than the current plans, while still allowing vegetation treatments when they benefit the riparian and thus aquatic resource.

Riparian Areas

Additional riparian protection would be provided since the inner riparian management zone would be increased to 100 feet for all fish bearing streams as compared to 50 feet (on slopes less than or equal to 35 percent) following state stream management zone laws. There would also be a riparian management zone on all ponds and wetlands regardless of size, which is a change from the current plans. The revised plan alternative direction is more comprehensive than the current plans and would be applied across the entire national forest. This would be largely consistent with other forests in the Northern Region and even throughout the Pacific Northwest (Thomas and Raphael 1993, Reeves et al. 2016). The Custer Gallatin National Forest riparian management zones would not cover as much area as other forests in Region 1 (200 feet as opposed to 300 feet on either side of fish bearing streams).

Table 25 displays riparian management zone acreages by category of riparian management zone in the six different geographic areas. Each column is listed by the riparian management zone category and the distance (in feet). The total acres outside the riparian management zone is provided for perspective.

Riparian management zones are not exclusion for no management zones, rather, they limit those actions that could degrade conditions. Guidelines are designed to protect riparian and aquatic resources by taking a multi-scale and multi-resource hard look at stream habitat and riparian conditions prior to entry. Forest management is allowed to occur with greater flexibility in the outer portion of riparian management zones than the inner portion. The greater protection provided by action alternative plan components, including riparian management zones and conservation watershed networks, would maintain and enhance habitat for aquatic species, including species of conservation concern, more rapidly than the current plans. Implementing the riparian management zone plan components would also maintain or enhance hyporheic groundwater by allowing for surface water-groundwater connections.

Table 25. Riparian management zone (RMZ) acreages by category of RMZ by geographic area (GA)

GA	Outside RMZ	Category 1 (100 ft)	Category 1 (200 ft)	Category 2 (100 ft)	Category 3 (100 ft	Category 3 (150 ft)	Category 4 (100 ft)	Category 4 (50 ft)	Total
Sioux	14,6971	317	306	5,565	86	41	1,029	10,145	164,460
Ashland	418,814	1,065	1,037	14,984	63	38	72	50	436,124
Pryors	67,138	416	417	5,119	0	0	133	1,844	75,067
AB	1,223,074	16,913	16,662	30,009	31,936	10,020	7,913	16,767	1,353,295
BBC	186,685	3,481	3,409	5,552	1,483	671	668	3075	205,025
MHG	674,409	11,896	11,733	21,313	22,767	5,009	7,234	50,938	805,299
Total	2,717,091	34,088	33,565	82,541	56,335	15,779	17,050	82,818	3,039,269

AB = Absaroka Beartooth Mountains; BBC = Bridger, Bangtail and Crazy Mountains; MHG = Madison, Henrys Lake, and Gallatin Mountains

Aquatic Species and Habitat

The effects of plan components on aquatic sensitive species would improve habitat conditions allowing them to improve over the life of the plan. The riparian management zone plan components in all revised plan alternatives would only allow management activities that maintain or enhance those RMZs (much of which is habitat for sensitive species).

Plan components would provide protections for aquatic species categorized as Northern Region sensitive, species of conservation concern, endangered species, and at-risk categories. The riparian management zone plan components in all revised plan alternatives would only allow management activities that maintain or enhance those riparian management zones, much of which is habitat for sensitive species. The effects of plan components on species of conservation concern, western glacier stonefly, would not vary between revised plan alternatives. Riparian management zone guidance would provide protections from potential new trails that may occur in alpine or subalpine western glacier stonefly habitat. Due to the very remote habitat, lack of infrastructure anywhere near their habitat, protected status (all current known habitat is designated wilderness), and lack of saleable timber, all management actions across alternatives would not impact the western glacier stonefly. The potential effects of climate change (outside the management purview of this forest plan), would decrease glaciers and permanent snowfields —a key habitat component for this species— could therefore degrade habitat for the western glacier stonefly. However, Halofsky and Peterson (2016) project the montane portion of the Custer Gallatin to be a relatively cooler aquatic habitat as compared to other areas in the Northern Rocky Mountains. This may be beneficial to local species populations such as cutthroat trout, but more data is needed on western glacier stonefly to determine its specific habitat distribution and niche on the Custer Gallatin.

The western pearlshell, a Custer Gallatin species of conservation concern, has low tolerance for sediment and the riparian management zones in the revised plan alternatives would help decrease sediment inputs to streams that would benefit habitat conditions of this mussel. The revised plan alternatives would also benefit the westslope cutthroat trout, which in turn benefits the western pearlshell. In particular, continued work by the Custer Gallatin National Forest and partners to increase the abundance of westslope cutthroat on the landscape would be beneficial for the western pearlshell. If climate change continues to increase air and water temperature, western pearlshell would be negatively affected because increased temperatures could limit the extent of the temperature sensitive westslope cutthroat trout.

The Conservation Watershed Network identifies watersheds that would be expected to have cold montane water or intact pine savanna aquatic habitat to support native fish, and other aquatic species, into the future in the face of climate change. A guideline for these watersheds is no net increase in road lengths and stream crossings that would hold effects from these management activities constant at a minimum assuming existing infrastructure is maintained or improved through the life of the plan. This would reduce potential new sediment inputs, benefit aquatic species, and improve overall ecological function. Conservation Watershed Network watersheds would be improved by plan objectives to storm proof five to eight miles of road per and replace stream crossing structures to meet aquatic organism passage design criteria making them passable for aquatic organisms such as cutthroat trout or prairie fish species.

Forest management can unintentionally introduce aquatic invasive species, which is one of the greatest threats to native aquatic species. Therefore, components of the plan require mechanisms for addressing aquatic invasive species. The revised plan alternatives require using current best practices for equipment washing before and after entering an area. This better assures that these components are included as resource protection measures at the project level. These activities would include, but aren't limited to: transporting water across drainage boundaries for fire suppression, constructing stream fords, operating equipment in a riparian area and near a watercourse, and the use of pumps and sumps for fire suppression, or construction related dewatering activities. Thus, the revised plan alternatives provide a mechanism for protecting aquatic native species from threats of aquatic invasive species.

Benefits to People and Source Water Protection Areas

Source water protection areas have been delineated by Montana Department of Environmental Quality and South Dakota Department of Environment and Natural Resources on and downstream of National Forest System lands. Over the life of this plan, drinking water demands will increase for towns with fast-growing populations, like Bozeman, that are dependent on water from the Custer Gallatin. Plan components have been developed to protect groundwater, surface water, water quality, and source water protection areas by ensuring that activities are consistent with state source water protection plans, best management practices that control pollution are implemented, and that beneficial uses are provided for. These plan components are expected to provide adequate protection to source water protection areas and to maintain water quality under all the revised plan alternatives.

Effects That Vary Among the Revised Plan Alternatives

Several plan objectives would improve aquatic species and their habitat, water quality, and riparian ecosystems in both lotic and lentic systems on the Custer Gallatin. The specific restoration activity, and thus effects analysis, would be determined at the project level. An example of stream mile restoration (or lake, wetland, or pond acres restoration) project could be planting willows to stabilize stream banks. Alternative D has the most benefit by restoring 800 stream miles per decade as compared to 600 stream miles per decade in the current plans, alternatives B, and C and only 200 miles per decade in alternative E. Similarly, lakes, ponds, and wetlands would receive the most restoration activity under alternative D with 100 acres of restoration per decade, while the current plans, alternatives B, and C would provide 50 acres of restoration activities per decade and alternative E providing for only 10 acres per decade.

At risk aquatic species would benefit the most from 8 to 10 enhancement projects in alternative D. Current plans, alternatives B, and C would have 5 to 7 enhancement projects per decade and alternative E would only provide for 1 to 3 enhancement projects per decade. Specific projects, and thus specific effects, would be determined at the project level; however, an example could be installing a barrier to protect a native fish species from non-native fish species that could outcompete or hybridize with the native species.

The objective to remove recreation sites or facilities to locations outside the riparian management zone would benefit the riparian management zone and aquatic species and their habitat. These locations are developed areas that can increase sediment delivery to lotic or lentic waters and trees are often removed which provide thermal cover and large woody debris input to streams. When these facilities are located in the riparian management zone, removing them in some cases would allow for floodplain reconnection, which would improve hyporheic-surface water connections. Removing these facilities or sites would have benefits over the long term once removal and rehabilitation are complete. Alternative D would be the most beneficial by removing seven per decade with the current plans, alternatives B, and C removing five per decade and only two per decade in alternative E.

In summary, alternative D would move toward the watershed, aquatic, and riparian desired conditions faster than the other alternatives. Alternative E would move toward the watershed, aquatic, and riparian desired conditions slower than the other alternatives. The current plans, alternatives B, and C propose the same objectives and the rate of progress toward desired conditions would be between alternatives D and E.

Consequences to Water Quality, Aquatic Species and Habitats, Groundwater, and Riparian Ecosystems from Forest Plan Components associated with Other Resource Programs or Management Activities

Effects from Vegetation, Timber, Fuels and Fire Management

Vegetation treatments are typically designed and implemented to achieve multiple ecological, social, and economic objectives including those associated with watershed management. This section focuses on the effects of alternatives from timber harvest (including the use of logging systems), fuel-reduction activities, and fire management. Specific effects from roads are treated separately due to their higher risk for affecting water quality and quantity.

Plan objectives of the current plans, alternatives B, and C propose 6,000 to 7,500 acres per year of vegetation treatments; alternative D proposes 8,000 acres; and alternative E proposes 5,000 acres. Effects to water quality would be minor for all revised plan alternatives because plan components minimize the impacts of harvest.

However, impacts would vary slightly across alternatives where indirect impacts could be delivery of sediment from temporary roads and those rare situations where a landing may be located in a riparian management zone. Alternative E has the highest volume of timber and wood products across the least acres, by harvesting larger trees, and thus less potential infrastructure such as roads, which would be more beneficial to water quality. Alternative D has the lowest volume of timber and wood products, across the most acres, potentially requiring more infrastructure such as roads and thus the least beneficial alterative to water quality.

Water quality effects attributed to timber harvest could include increased sediment, nutrient loading, and changes to water temperature. However, the revised plan alternatives would not increase the risk of impaired water quality over the current conditions. This is because the revised plan alternatives provide more robust protections to reduce that risk by increasing the widths of riparian management zones and limiting activities that degrade conditions in the riparian management zone, particularly the inner riparian management zone. Thus, trees would not be cut, especially in the inner riparian management zone, unless it could be demonstrated that this would improve riparian management zones, for example selectively cutting conifers to encourage growth of hardwoods. This would be done on at a project specific scale where, for example, it was determined that hardwoods were underrepresented by excessive fire suppression. By ensuring the inner riparian management zone stays intact, or improves in habitat quality, shading would ensure stream temperatures are moderated from solar input and this would in-turn benefit aquatic species like cutthroat that are sensitive to stream temperature increases. Additionally, the plan components placed on vegetation treatments within riparian management zones substantially reduces risk of increased nutrient loading from adjacent harvest areas. While current actions under the current plans' direction does not show a strong connection of upland vegetation treatments producing nutrient loads in streams beyond state standards on the Custer Gallatin; this has not been sampled specifically to test for this connection, or lack thereof. Overall, the effects from timber harvest on water quality in streams is not expected to vary measurably across the revised plan alternatives.

The revised plan alternatives would use best management practices to reduce off-site transport of sediment to streams, and other waterbodies, from areas influenced by timber or fire management activities. Best management practices would stabilize skid trails and landings and disconnect them from road ditch and stream networks, drawing on Northern Region soil and water conservation practices (Forest Service Handbook 2509.22, Northern Region and Intermountain Region Amendment No. 1). The effect would be reduced risk for runoff and sediment to waterbodies. According to state of Montana audits of Forest Service best management practices were effective 96 percent of the time (Ziesak 2015). Using a similar audit scheme, the Forest Service was 100 percent effective in establishing the correct buffer to meet Montana's design standards for streamside management zones (Ziesak, 2015). The effectiveness of best management practices at avoiding sediment was reviewed in a contemporary study in California. Out of 220 units examined, skid trails delivered sediment to streams in 16 instances (Litschert and MacDonald 2009). The authors concluded that, in most cases, best management practices were effective at preventing sediment delivery to streams. Surface roughness on skid trails was one of the factors that was found to alleviate overland flow and sediment delivery. The Custer Gallatin uses slash in addition to water bars to stem overland flow and reduce sediment delivery. Also, the national forest has diverse geology where potential impacts, and the necessary best management practices, would be variable and need to be addressed at a project scale.

Potential risk to water quality and other differences between the alternatives may be subtle since the extent of timber harvest within a watershed is typically limited by many factors, including forest plan direction associated with other resource considerations (such as providing for wildlife habitat) and physical conditions such as terrain and access. Recent studies showing the water yield changes due to beetle epidemics have brought out the complex relationships between forest canopy and water yield in snow-dominated regimes (Biederman et al. 2015). Although decreases in forest cover can increase snowpack and available moisture, the lack of shading can accelerate snowpack runoff (Varhola et al. 2010). Shading can offset snowmelt losses where the forest canopy remains. Furthermore, (Grant et al. 2008) in a review of water yield studies, showed that fall soil deficits between cut and uncut stands explained water yield differences; cut stands lacked transpiration and thus were prone to generate greater yield since their soils had more available water and thus were less prone to infiltrating fall storm moisture. On the Custer Gallatin, soils rarely have saturated soil conditions during the fall, and thus these differences would be subtle and localized. Under all revised plan alternatives, the amount of acres suitable for timber production is less than current management at 665,241 acres (alternative E = 595,464; alternative D = 549,983; alternative C = 567,357; alternative B = 582,301).

Under the revised plan alternatives, prescribed burning would occur to achieve multiple objectives, including reduction of fuel hazard, preparation of the site for tree regeneration, and stimulation of the growth of shrubs and other plants. Revised plan alternatives goals would be to benefit wildlife where past management activities, or other anthropogenic effects, have decreased their presence. Wildland fires would also expected to be applied to lands outside of timber harvest units (which may include riparian management zones if it maintains or enhances the riparian ecosystem), for example, to restore fire as a natural ecological process and build desired vegetation structure and composition across the landscape, which includes riparian management zones. Fire is a tool that can be used to benefit riparian management zones, streams, and lentic habitats such as wetlands. However, there is uncertainty on how to treat riparian management zones specifically and monitoring these treatments would help guide an adaptive management process.

Across revised plan alternatives, objectives propose 4,000 to 7,000 average annual acres of non-harvest-related wildland fire for hazardous fuels across the Forest. The amount projected would be lowest under alternative E and highest under alternative D. Where these acres are burned would be determined at the project scale and watershed and riparian management zone plan components would ensure those resources are protected. Where wildland fire is applied and blackens an area, runoff can increase from reduced infiltration. Blackened soil areas can accelerate runoff due to soil sealing from ash that lowers the infiltration capacity of soils (Doerr et al. 2006). These conditions vary spatially and decrease over the first year as products of burning in the soil degrade, (Doerr et al. 2006). Natural forest conditions have hydrophobic characteristics such as plant litter waxes and resist infiltration when soils are dry, but the main difference after a wildland fire is that burned areas lack the surface roughness to dissipate rain splash energy and interrupt runoff. Other factors that increase runoff from harvested and burned areas are steep slopes, low groundcover, and long slope lengths (Elliot 2013). Runoff transports loose soil particles and deposits sediment down the slope proportional to runoff energy. One reason sedimentation decreases over time is that the sediment supply decreases after bare surfaces armor, lacking a ready sediment supply. However, the impacts from prescribed burning activities across the Forest are expected to be minor since the burning is mostly anticipated to be low- and moderate-severity, with low potential of delivering sediment. Additionally, prescribed burning would lower the possibility of extreme stand replacing wildfires and thus potential for larger sediment runoff events. The effects of prescribed burning have been identified as generally insignificant with regard to a wide range of hydrologic and water quality variables (Robichaud et al. 2000).

Wildland fire has the potential to offset effects that could occur from high severity wildfire, particularly if high severity fire should occur in unnatural amounts and shortened timeframes as a result of climate change. However, a percentage of fire has always been high severity depending on various conditions and though damaging at a site scale this scenario has historically been a part of natural disturbance regimes affecting streams (Reeves et al. 1995) and uplands (Hutto et al. 2016). In response to disturbance the stream channel and adjacent riparian area, or floodplain, at a large scale reach a balance of erosion and deposition of sediments, and other materials, that forms and maintains the stream channel and aquatic habitat (Stanford et al. 2005). But vegetation-altering wildfire can change the timing and input of sediment into stream channels, causing detrimental impacts to fish and aquatic macroinvertebrates at a site scale, particularly under climate change scenarios where these fires could become more frequent (Goode et al. 2012). Leonard et al. (2017) found that high intensity fire in a headwater stream had adverse effects on salmonid habitat through decreased streamside canopy cover followed by increased stream temperatures, incised and unstable streambanks, and lower nutrient concentrations 21 years post-fire. In the same study Leonard et al. (2017) found macroinvertebrates were virtually temporarily eliminated initially, but had fully recovered to reference conditions for richness, diversity, and abundance 21 years later. From this standpoint effects from severe fires can seem dramatic at the local scale, but stream ecosystems, riparian areas, and the organisms that inhabit them are adapted to this disturbance (Mihuc and Minshall 2005, Malison and Baxter 2010). Thus, fire is a phenomenon that can reset successional pathways and ultimately benefit aquatic and riparian ecosystems. A wildland fire objective of a minimum of 375,000 acres burned per decade would mimic natural disturbance processes. Overall, the expected effects from fire related management actions are expected to be minor. However, there are many local to larger scale climatic factors beyond the control of the Forest Service that may determine how streams and their biota react to these fire events if wildland fires move out of a natural range.

Effects from Wildlife Management

In general, wildlife management direction has low impact or a net positive impact on water quality, aquatic species habitat, and riparian management zones. All alternatives would adopt the Grizzly Bear Conservation Strategy. Associated plan components that would require secure habitat to be maintained may limit access, and thus impacts could increase sediment inputs to waterbodies within the Greater Yellowstone Ecosystem Recovery Zone; thereby benefitting watershed integrity.

Effects of Land Allocations for Recommended Wilderness, Backcountry Areas and Eligible Wild and Scenic Rivers

Many watersheds in the Absaroka Beartooth; Madison, Henrys Lake, and Gallatin Mountains; and Bridger, Bangtail, and Crazy Mountain Geographic Areas that support the healthiest populations of native trout and other aquatic species, currently have their headwaters protected through lands managed as Congressionally designated wilderness areas (Lee Metcalf and Absaroka Beartooth) or inventoried roadless areas. These areas are the building blocks of a conservation network. Naturally functioning headwaters have a large influence on the function of downstream reaches (Vannote et al. 1980, Meyer et al. 2007) and would be particularly important as refuge habitat for cutthroat trout, and other species, in light of potential effects of climate change (Isaak et al. 2015). The best remaining trout habitat conditions are found in wilderness and unroaded landscapes (Rhodes et al. 1994, Kershner et al. 1997). Across the west, roadless areas tend to contain many of the healthiest of the few remaining populations of native trout, and these are crucial to protect (Kessler et al. 2001). Roadless areas are a source of high-quality water essential to the protection and restoration of native trout. The high-quality habitats in roadless areas help native trout compete with non-native trout because degraded habitats can provide non-natives with a competitive advantage (Behnke 1992). Roadless areas tend to have the lowest degree of invasion of non-native salmonids (Huntington et al. 1996).

Therefore, forest plan allocations such as recommended wilderness areas backcountry areas, and eligible wild and scenic rivers that limit road building can be expected to contribute to naturally functioning headwaters. The revised plan alternatives propose 30 streams as eligible wild and scenic rivers, and new roads would be limited in the 18 rivers with a tentative wild classification. In contrast, the current plans have 11 eligible wild rivers. Alternative D would provide the greatest benefit to aquatic species because it would allocate the highest amount of recommended wilderness and backcountry areas, followed by alternatives C, B, E and the current plans.

Effects from Recreation Management

Recreation use can affect water quality, clean drinking water, and aquatic communities particularly from trail use and recreation facilities located in riparian management zones. Impacts from the use of trails in riparian management zones may include rutting, erosion, and loss of groundcover from user-created trails; trampling of vegetation; vegetation removal; and soil compaction near waterbodies. Rutting may increase surface erosion associated with heavily used trails. High-use campsites in riparian management zones may cause root damage in trees, resulting in reduced vigor and mortality. In combination, these activities can lead to increased erosion and a reduction in water quality.

Current recreation use and increased future recreation use elevates the risks to water quality, clean drinking water, and aquatic communities. Indeed the largest economic contributor the Custer Gallatin National Forest provides is varying recreation opportunities (economics section provides more details), and the Custer Gallatin has angling opportunities that attract national and even international visits from anglers. One of the greatest threats to native aquatic species from recreation is the potential introduction of aquatic nuisance species.

Trail maintenance is a key to decreasing impacts to watershed health. Sediment erosion from trail use outside of riparian management zones mainly is routed onto the national forest floor with no impact on water quality, and these impacts are typically localized. On the Custer Gallatin, observations conclude that nonmotorized trails are generally known to have less impact on aquatic species than motorized trails, but can contribute to decreased water quality through increases in sediment delivery to streams. Nonmotorized trails can have impacts when located close to streams, when particularly steep, at crossings, and there are differences between user types. Subjective observations indicate that certain situations, such as steep slopes combined with equestrian traffic, can have increased erosion compared to other nonmotorized uses. However, one study (Wilson and Seney 1994) found that horseback and hikers made more sediment available than either motorcycles or off-road bicycles. This study lacked the rigor and statistical significance to prove these findings and Custer Gallatin staff is not aware of other research on the Custer Gallatin that would provide more insight.

Plan objectives propose maintaining 30 percent of trails to standard per year across all alternatives, though the concentration would be in front country for alternative E. Plan objectives propose some annual trail maintenance (although not to standard) at 80 percent in the current plans, alternatives B, and C, and 30 percent in alternatives D and E. When trails close to water sources are not maintained the probability of affecting water quality by delivering sediment to waterbodies would increase. Trail maintenance inside riparian management zones can affect large wood recruitment and function that influences stream channel morphology and aquatic habitat. Bucking out fallen trees can reduce the tree's length and sever the bole from its root wad. Smaller tree lengths are not likely to contribute as much to stream channel stability and are more likely to be washed out during high streamflow events, but overall trail maintenance is generally beneficial. Smaller instream wood also delays the recovery of channel features needed to maintain habitat for aquatic species, including overhead cover and low-velocity refugia during high-flow events.

Spread of invasive aquatic species is not typically a concern from users on non-motorized trails. Spread of noxious weeds from non-motorized recreation and resultant treatment with chemicals may cause negative impacts if improperly used. Use of chemicals is generally discouraged in riparian management zones.

Plan components under all revised plan alternatives direct new developed recreation facilities, including trails, to be located outside of the inner riparian management zone to protect aquatic resources and riparian-associated plant and animal species. This is an improvement from the current plans. Exceptions may occur if actions are to address human health and safety issues or if the new facility is water-related, such as a boat ramp. In addition, new solid and sanitary waste facilities should not be placed in the inner riparian management zone. However, it is assumed that minor, localized impacts to riparian vegetation, woody debris, and water quality would still occur where existing recreational use and facilities are located.

Effects from Scenery Management

The forest plan scenic integrity objectives do not outright prohibit on-the-ground actions, but may influence the design or the location of watershed projects that would be visible from any of the listed critical viewing platforms. Design features or mitigations may be required to meet or exceed the assigned scenic integrity objective, which describes the lowest threshold of visual dominance and deviation from the surrounding scenic character.

Effects from Access by Roads and Motorized Trails Management

The road network on the Custer Gallatin affects water and watershed resources in both an acute and a chronic manner and this would continue under all alternatives. There are motorized roads open to the public as well as administrative use within the national forest administrative boundary. This includes roads managed by other entities such as state or Federal highways, a variety of county roads, state and Federal land management agencies, and private roads. Many roads and motorized trails are located within riparian management zones (which include many road-stream crossings). Routes located closest to water resources potentially provide a background level of disturbance that contributes to effects to watershed, aquatic, and riparian resources.

Past culvert failures and road slumps have impacted water quality and aquatic organism migratory patterns particularly at the site-level scale. Forest roads that are maintained on an annual basis are typically those roads that have the most administrative and visitor use. Closed roads receive less maintenance, and not all of these roads were put into proper storage in the long term or had their culverts removed. There are stream crossings located on administratively closed Forest Service roads with some culverts remaining that do not receive regular maintenance.

Aquatic organism passage devices would be installed over the course of this forest plan. These would allow fish and other organisms to move up and downstream where they currently are blocked from doing so by older culvert design or culvert failures. Plan objectives of the current plans, alternatives B, and C propose 5 to 7 projects per decade, alternative E proposes 1 to 3 projects per decade, and alternative D would provide the most benefit to aquatic species by proposing 7 to 10 projects per decade.

Forestwide direction under all revised plan alternatives includes guidance that would direct road management on the Custer Gallatin to address the detrimental effects of roads on water quality and aquatic biota. The removal of stream-crossing culverts and reestablishment of a natural stream grade or installation of fish passable culverts are expected to have the greatest positive impact on water quality and aquatic biota and their habitat. Revised plan alternatives would sequentially improve crossings and reduce the risk of failure across the national forest as funding became available (particularly in the conservation watershed network) and this would decrease the amount of sediment delivery to streams from road failures. These reductions would also result from the application of best management practices that prevent gully formation and downcutting through newly excavated stream channels. For example, establishing a stream bed that mimics the natural stream gradient above and below the crossing, placing cobble-size rock in newly excavated streambeds, distributing any uprooted vegetation, and slash across stream-adjacent disturbed areas.

Under alternative C, about 3.6 miles of trail would no longer be available for motorized and mechanized recreation use and another 20 miles of trail would no longer be available for mechanized recreation use. Under alternative D, about 256 miles of trail would no longer be available for mechanized recreation use and about 172 miles of trail would no longer be available for motorized or mechanized recreation use. Neither the current plans nor alternatives B and E make any changes to existing trail uses. Alternative D would provide the most benefit to aquatic resources by removing motorized and mechanized recreation use from the most trail miles; thereby reducing potential soil disturbance from these activities. Observations on the Custer Gallatin indicate motorized, more than mechanized, trails function similar to roads in regards to soil disturbance, sediment delivery to streams, and thus potential for water quality issues. However, impacts are generally less than roads as there is less disturbed surface area. There is also the potential that removing motorized use from some trails could lead to an increase of motorized use on other trails. This concentrated, or focused, motorized use could have higher impacts to aquatic resources especially if maintenance and upgrades (for example, surfacing and bridges) are unable to keep up.

Plan objectives for all alternatives propose to decommission 40 miles of road, which would benefit water quality, aquatic species habitat, and riparian management zones in the long term depending upon the proximity and extent of roads near water. As described in the general effects, there would be some short term impacts to water quality from the sediment delivery during excavation activities in or adjacent to waterbodies.

Road maintenance is expected to continue at similar levels or slightly decreased levels compared to more recent management. Plan objectives for all alternatives propose to maintain 75 percent of passenger roads per year. High clearance roads would be maintained at 20 percent per year for the current plans, alternatives B, and C; five percent per year for alternative D; and 10 percent per year with a focus on timber harvest roads for alternative E. Portions of the road network would be treated to repair and improve drainage structures, improve the running surface of the road, and to clear vegetation along roadsides. Short-term increases of sediment delivery to streams and waterbodies would be expected as a result of road surface grading, and culvert and ditch cleaning near waterbodies. However, road and culvert maintenance and upgrades generally have positive effects for water quality and aquatic species habitat over the long term. Proper maintenance of the Custer Gallatin road system is critical for aquatic resources.

Portions of the road system that are in particularly poor condition or are currently closed and in long-term storage, would be reconstructed periodically; particularly in connection with land management activities, such as timber harvest projects. Road reconstruction includes application of surface rock, replacing damaged or poorly functioning culverts, adding stream-crossing or ditch relief culverts where necessary, some road widening, and removing roadside vegetation that is encroaching on the road surface and preventing vehicular passage. Again, these activities would be expected to create some turbidity increases in nearby waterbodies, but best management practices would be employed to minimize erosion and sediment transport to waterbodies. A potential source for nutrients is phosphorus bonded to sediment (Wood et al. 2005, Ballantine et al. 2008). Detachment of soil particles and associated phosphorus is often linked to soil erosion, which provides a physical mechanism for mobilizing phosphorus from soil into waters (Wood et al. 2005).

Within the recovery zone for grizzly bears, there would be no net increase to the baseline open motorized route density or total motorized route density on National Forest System lands during the non-denning season under all alternatives. In addition, there would be no net increase in the length of roads and stream crossings inside riparian management zones for watersheds within the conservation watershed network. These plan components would be expected to minimize impacts to aquatic species from motorized activities across all alternatives.

Effects from Permitted Livestock Grazing Management

Objectives under the current plans, alternatives B, and C would provide about 219,000 animal unit months (AUMs) per year while alternatives D and E would provide for about 214,000 animal unit months per year. The differences among animal unit month objectives would affect water quality and aquatic habitat and species under the current plans, alternative B, and C if vacant allotments were to be re-activated. This would require site-specific analysis to determine effects to riparian management zones and aquatic species habitat. Alternatives D and E would also require site-specific analysis to determine effects to riparian management zones and aquatic species within active allotments.

The revised plan alternatives may limit livestock effects by having a minimum end-of-season stubble height guideline in low gradient alluvial channels (livestock grazing section guidelines provide more information). This plan component could benefit riparian ecosystems and aquatic species and habitat in those specific stream types. Goss and Roper (Goss and Roper 2018) demonstrated that generally in salmonid streams higher streambank stubble height, and lower streambank alteration, can be used as a proxy to improve stream habitat conditions. Revised plan alternatives also require new livestock handling or management facilities (for example, corrals) to be located outside of riparian management zones. The revised plan alternative plan components direction, as compared to the current plans, would decrease livestock grazing effects while not prohibiting livestock grazing use in riparian areas.

The revised plan alternatives are a slight improvement over the current plans. The effects of livestock can be seen across the planning area particularly in riparian areas. Historical grazing led to riparian vegetation changes and stream channel degradation on grazed streams. Various riparian areas and waterbodies have seen improvements through best management practices and revised allotment management plans. However, riparian and aquatic habitat improvement within allotments continues to be a challenge. Improper grazing by livestock can reduce bank stability and it often changes riparian vegetation, resulting in insufficient overhead cover for fish (Platt 1991). For montane landscapes an extensive review of PIBO data in montane streams of the Pacific Northwest and into the Northern Rocky Mountains was conducted (Kovach et al. 2018). The review found land-uses, and in particular livestock grazing with this study, was closely related to summer thermal regimes and suggested that this land-use may be additive with respect to climate change impacts already underway. Less is generally known about how grazing impacts the Northern Great Plains watersheds and water quality, given these systems are naturally more erosive than montane landscapes and waters are generally more conductive (have higher mineral content). Excessive grazing by both wild and domestic ungulates can remove woody plants (Batchelor et al. 2015), reduce the vigor of perennial forbs and grasses, and cause channel profile and function changes via bank collapse on low gradient streams (Trimble and Mendel 1995, Bengeyfield 2006). Widening channels, increased stream temperature and fine sediment, altered bank structure, and increased the loss of overhanging vegetation (that may occur from excessive grazing (Myers and Swanson 1996, Kershner et al. 2004b). This is often harmful to aquatic fauna, especially cold-water dependent species (Belsky et al. 1999, Saunders and Fausch 2007). A study of the effects of grazing on North Dakota badlands and prairie stream fish assemblages, conducted by Stephens and others (Stephens et al. 2016), found similar guilds in Ashland and Sioux geographic areas. This study also found it difficult to find any reference streams and recommended building enclosures, for years or even decades, would be important to accurately assess impacts to prairie stream fishes. This would facilitate understanding potential impacts from permitted livestock grazing in the Custer Gallatin National Forest pine savanna streams, as most streams and waterbodies in these units are open to grazing with 86 percent of all lands covered by primary rangelands within grazing allotments as compared to 6 percent in montane units.

Effects from Energy and Minerals Management

Suction dredging does occasionally occur on the Custer Gallatin. Large increases in mining activity within the riparian management zones are not anticipated for the future, but cannot be ruled out. The 1872 mining law allows for the development of locatable minerals, including gold and other minerals in streams. All locatable mineral activities are required to meet applicable environmental protection measures as required by both Federal and State laws, regulations, and policies. Proposed locatable mineral activities are subject to review and approval, as well as environmental analysis and reclamation and monitoring requirements.

All revised plan alternatives include direction that would provide adequate protection to water quality and other aquatic resources from the potential impacts due to energy or mineral extraction. Forestwide plan direction addresses the availability, management, and reclamation aspects of energy and mineral resources, with desired conditions that recognize the importance of reclaiming lands developed for mineral resources in an appropriate manner, in order to protect other resource values and human health. Standards and guidelines direct the implementation of new operations by requiring measures to mitigate for potential impacts to vegetation and potential water table alterations. If operations within riparian areas cannot be avoided, then measures to maintain, protect, and rehabilitate fish and wildlife habitat would be included in the authorization. Establishment of new sand and gravel (saleable mineral materials) mining and extraction operations within riparian management zones is prohibited.

Cumulative Effects

Cumulative effects are addressed in the context of surrounding land jurisdictions and land ownership. The Custer Gallatin National Forest is intermixed with lands of other Federal jurisdictions, state lands, and private lands. Some geographic areas contain significant solid inholdings of Federal lands, while some geographic areas are island mountain ranges largely surrounded by private lands.

Portions of the Custer Gallatin National Forest adjoin other national forests, each having its own forest plan. The forest plans for National Forest System lands adjacent to the Custer Gallatin include the Helena Lewis and Clark, Beaverhead-Deerlodge, Caribou-Targhee, Shoshone. Management of aquatic resources vegetation is broadly consistent across all national forests due to law, regulation, and policy. All of the forest plans contain plan direction that addresses aquatic ecosystems and promotes ecological integrity.

Bureau of Land Management lands near the Custer Gallatin are managed by the Dillon (2006 plan), Butte (2009 plan), Billings (2015 plan), Miles City (2015 plan) and South Dakota (2015 plan) field offices. Aquatic and riparian components of these plans are complementary to the plan components for the Custer Gallatin.

Federal actions within the montane areas can involve Yellowstone National Park as they manage some headwater streams in the Madison, Gallatin, and Yellowstone Rivers. There would be little to no cumulative effects from park management actions as most areas in the park are managed to protect ecological values.

Northwest Energy manages several dams including those on Hebgen, Quake, and Ennis Lakes in the Madison, Gallatin, Henrys Lake geographic areas and Mystic Lake in the Absaroka Beartooth geographic area. Dam operations are coordinated closely with the Forest Service and other partners to have the least impact possible on aquatic species habitat and riparian ecosystems. However, given the lack of a normative flow regime, coupled with potential influences of climate change, there is the potential of cumulative effects related to increased stream temperature and lack of flows to provide flood-pulses necessary to drive stream ecological processes. In some locations where Bureau of Land Management or State lands occur adjacent to National Forest system lands, the Forest Service would seek out opportunities for watershed projects that increase the scale of conservation efforts across administrative boundaries.

Non-Federal land management policies are likely to continue affecting riparian and aquatic resources. The cumulative effects across the large, geographically complex, and diverse Custer Gallatin National Forest lands are difficult to analyze considering the uncertainties associated with government and private actions, and ongoing changes to the region’s economy. The isolated nature of the Ashland and Sioux geographic areas make them particularly susceptible to changes outside the management purview of the Custer Gallatin. Whether those effects would increase or decrease across the national forest in the future is a matter of speculation; however, based on the growth trends and current uses identified in this section, cumulative effects are likely to increase. Many activities occur on private lands. These include water diversion, irrigation, livestock grazing, farming with varied cash crops, timber harvest, water-based hunting, outfitted and non-outfitted angling, construction of subdivisions, housing, and commercial development, building and stocking of private fish ponds, chemical treatment of noxious weeds, flood control and stream channel manipulation, and hydropower management.

Montana and South Dakota State owned school trust lands managed by the Montana Department of Natural Resources and Conservation will continue to support a variety of uses of their lands, from livestock grazing to mining, timber harvest, and recreational fishing and hunting. Montana law requires that school trust lands be managed to maximize income for the school trust. Management impacts may be greater on these lands than on other state or Federal lands but may not result in loss of fish populations.

In large part, montane stream systems on the Custer Gallatin originate in protected headwaters and eventually flow downstream onto lands owned or administered by entities other than the Forest Service. Many fish populations, whether they move off-forest as part of their life cycle or remain entirely within a localized area, require interconnectivity of these streams to survive as a population. For almost all species, genetic interchange between subpopulations is necessary to maintain healthy fish stocks. The more wide-ranging a species such as westslope and Yellowstone cutthroat trout, the more critical interconnectivity may be for the fish to be able to access important habitat components. Thus, activities off-forest that disrupt fish migration corridors can have significant impacts to fish populations upstream.

The most complex cumulative effects likely relate to the restoration of westslope and Yellowstone cutthroat trout. The complexity of the life histories of these species exposes them to many factors affecting their abundance and viability. Cumulative effects to native fish include, predation, hybridization, and competition with non-native fish; destruction or degradation of spawning and rearing habitat from logging, grazing, road construction or maintenance, and urban development on private and other non-Federal lands; degraded water quality as a result of polluted runoff from urban and rural areas; and migration barriers that result from roads on private or other non-Federal lands. Though much more difficult to quantify these same factors have the potential to affect prairie stream fish, and aquatic biota, populations in the pine savanna units.

Montana Fish Wildlife and Parks and the South Dakota Fish and Game have laws and regulations that are adequate to prevent the overexploitation of fish populations from angling impacts through their management of the fisheries populations across the Custer Gallatin. However, with an increasing human population, particularly in the montane areas, and other cumulative impacts mentioned in this section angling could be additive in the future.

In municipal watersheds, it is highly probable in frequently used recreation places like Hyalite and Bozeman Creek (also municipal watersheds or source water protection areas) that the continued projected increase in population would lead to conflicts between recreation and clean public drinking water demand. Project-scale actions under the current revised plan alternatives provide the framework to achieve goals for source water protection requirements, but there is a threshold where these watersheds (and perhaps others on the Custer Gallatin) would reach maximum recreation potential where more activity would degrade the ability of the watershed to provide clean drinking water.

Conclusion

The suite of the revised plan alternatives' watershed, aquatic, and riparian ecosystem plan components are designed to maintain or restore the ecological integrity of the Custer Gallatin National Forest. Additionally, these components will facilitate ecological conditions moving towards desired future conditions. The watershed, riparian management zone, and conservation watershed network plan components would provide protections for those resources greater than has been provided in the current plans. The riparian management zone direction would be easy to follow, consistent forest-wide, and similar to other forests across the western United States, while recognizing the more arid environment of the Custer Gallatin. While these protections are more stringent than current plans, they would still allow for the multiple use mission of the Forest Service by restricting only those activities, such as road building in the riparian management zone, which would cause deleterious effects to the resource.

Overall, alternative D would provide the greatest ecological benefit to aquatic species habitat, riparian areas, and watersheds. The current plans, alternatives B, and C propose more road and trail maintenance than alternatives D and E. Alternative D proposes the greatest acreage of vegetation management activities. Alternative D would allocate the highest amount of recommended wilderness and backcountry areas, followed by alternatives C, B, E and the current plans. Alternative D also proposes to remove motorized and mechanized recreation use from the most miles of trail, while the current plans, alternative B and alternative E would make no changes to these current uses.

Plan objectives that improve ecological conditions for aquatic species habitat, riparian areas, and watersheds are highest in alternative D and lowest in alternative E. Alternative D would move toward the watershed, aquatic, and riparian desired conditions faster than the other alternatives, and alternative E would move toward the watershed, aquatic, and riparian desired conditions slower than the other alternatives.

Occurrences of all Regional Forester sensitive and at-risk aquatic species are expected to persist on the Custer Gallatin under all alternatives. Policy and plan components under the current plans' protects are known sensitive aquatic occurrences and habitats. Plan components under the revised plan alternatives provides ecological conditions to maintain known at-risk aquatic occurrences and habitats that persists and are resilient and adaptable to stressors (Appendix C, At-risk Species Plan Components).

3.5 At-Risk Plant Species

3.5.1 Introduction

At-risk plant species are federally recognized species under the Endangered Species Act (threatened, endangered, proposed, and candidate species) and species of conservation concern. A species of conservation concern is a "species, other than federally recognized threatened, endangered, proposed, or candidate species, that is known to occur in the plan area and for which the Regional Forester has determined that the best available scientific information indicates substantial concern about the species' capability to persist over the long term in the plan area" (36 CFR 219.9(c)). Management actions that disturb or disrupt soil surfaces within a particular portion of the Custer Gallatin could affect the capacity of that landscape to support at-risk plants.

The 2012 Planning Rule directives (FSH 1909.12) requires coarse-filter plan components (habitat conservation) be developed, and fine-filter plan components (species specific) if necessary (appendix C), to contribute to the recovery of listed species, conserve proposed and candidate species, and to provide the desired ecological conditions necessary to maintain populations of species of conservation concern within the plan area. A key assumption of the course filter approach is that if ecological conditions that provide the habitat that species depend on remain intact (well represented and distributed), most species will be maintained. Moreover, is it assumed that by maintaining these conditions, critical ecological and evolutionary processes such as nutrient and sediment transport, biotic interactions, dispersal, gene flow and disturbance regimes, will also be maintained and provide the necessary environmental conditions for climate adaptation (Beier and Brost 2010).

At-risk plants contribute to diversity on the landscape and opportunities for botany enthusiasts. Refer to the general contributions to society and economic sustainability section for more information about multiple uses, key ecosystem services, and benefits to people.

Regulatory Framework

Endangered Species Act of 1973, administered by U.S. Fish and Wildlife Service: protect and recover imperiled species and the ecosystems upon which they depend.

Forest Service Manual 2670: applies to Regional Forester's sensitive species.

Record of Decision (2012 Planning Rule) detailed in 36 Code of Federal Regulations [CFR] 219.9 and the associated directives in FSH 1909.12.5: Species at-risk on the Custer Gallatin National Forest includes species of conservation concern designated by the Regional Forester of the Northern Region where best available scientific information indicates substantial concern about the species' capability to persist on the national forest over the long term. The revised Forest Service manual policy regarding species of conservation concern is forthcoming and the changes and impacts are not known. The current management direction is to evaluate proposed management activities and project areas for the presence of occupied or suitable habitat for any plant species listed under the Endangered Species Act or on the Regional Forester sensitive species list (the current plans). Forest Service policy is expected to include similar policy to maintain the persistence of species of conservation concern (alternatives B through E) on the Custer Gallatin. Additional information regarding species of conservation concern policy is expected following the release of this plan.

Key Indicators and Measures

Species specific and habitat guild (habitat type group) conditions and threats will be qualitatively evaluated. Adverse impacts to at-risk plant species result from plan components that increases surface disturbance and competition from invasive species spread or alters hydrological processes. The principle beneficial impacts include, plan components that protect, maintain, or restore habitat conditions in known occurrences or potential at-risk plant species habitat.

Key Indicators Used to Compare Alternatives

Habitat quality by evaluating changes in land allocations generally considered low risk to ground disturbance measured in acres by alternative of designated wilderness areas, wilderness study area, recommended wilderness areas, inventoried roadless areas, backcountry areas (low development areas), designated wild and scenic rivers, and research natural areas.

Potential competition from invasive weed species by evaluating changes in miles motorized route weed spread vectors.

Methodology and Analysis Process

The U.S. Fish and Wildlife Service is responsible for determining species recognized under the Endangered Species Act as threatened, endangered, and proposed or candidate. Once identified, the Forest Service is responsible to manage for the ecological conditions that would contribute to the recovery of the listed species and conserve proposed and candidate species. Determining effects to federally recognized species by alternative considers the degree of management activities or natural conditions that may pose potential stress or threat to the species.

The 2012 Forest Planning Rule provides direction for determining which of species to be potential species of conservation concern, as described in the previous introduction section. The list of potential species of conservation concern must meet the mandatory requirement (FSH 1909.12 Section 12.52) that the best available scientific information indicates substantial concern about the species' capability to persist over the long term in the plan area. This information may be derived from the scientific literature, species studies, habitat studies, analyses of information obtained from a local area, or the result of expert opinion or panel consensus. Additional information is available in the assessment and the Region 1 Species of Conservation Concern web page.

Once species of conservation concern were defined, ecosystem characteristics for species were evaluated and determinations made on whether forestwide components maintained habitat quality needed by associated species of conservation concern by considering known locations of species and their habitats, as well as key drivers or stressors. Additional species-specific plan components were then considered and developed if needed. In other words, the extent and condition of each ecosystem or special type served as the habitat indicator for individual species, and for assemblages of at-risk species and overall floristic diversity. For most species, extent and condition of habitat typically constitute the best available scientific information indicating whether such populations would continue to persist with sufficient distribution in the planning area (2012 Rule Sec. 219.19). However, known occurrences, trend data, and known threats to species persistence were used when available to compare each alternative.

Determinations for each species consisted of a persistence evaluation, which examined whether plan components provide ecological conditions necessary to maintain a viable population of each species of conservation concern in the plan area. The persistence evaluation was conducted using both a coarse filter and a fine filter approach (again using known occurrences), habitat extent and condition, and known threats as indicators. For the coarse filter approach, species were grouped by habitat guilds. This coarse filter approach assumes that persistence of species of conservation concern is broadly dependent upon the integrity of the coarse ecosystems where they currently occur. Qualitative, rather than quantitative, evaluations were made to compare the revised plan alternatives to the current plans forestwide plan components. The coarse filter approach was used to compare forestwide plan components of the current plans with the revised plan alternatives using habitat guilds and considering species in a broader context. However, the habitat guilds outlined below are roughly, but not exactly, aligned with floristic geographic subdivisions, to which at-risk plant populations are often associated. Since the integrity of whole ecosystems does not necessarily ensure persistence of all species of conservation concern, particularly those with very limited distribution, an additional fine filter analyses was conducted (by species-specific occurrences and habitat indicators) to ensure that persistence is provided for all plant species of conservation concern to compare each alternative.

Impact analyses and conclusions are based on interdisciplinary team knowledge of resources on the Custer Gallatin, review of existing literature and information provided by other agencies. Effects are quantified where possible. In absence of quantitative data, best professional judgment was used. Spatial analyses were conducted using geographic information system (GIS) data and analyses. Impacts are described using ranges of potential impacts or in qualitative terms, if appropriate.

Other assumptions used in the analysis that are common to all alternatives include: designated wilderness, wilderness study area, the 2001 inventoried roadless areas, and research natural areas would continue to be managed designated; there would be a general increase in recreational demand as the human population increases; weeds and weed seeds would continue to be deposited and spread onto and within the Custer Gallatin; and climate change trends would continue as projected, with warming temperatures and variable precipitation. The general management strategies in the draft revised plan appendix A would be followed for all revised plan alternatives.

At-risk species occupy specific habitats on the landscape. There is limited data regarding trends for many at-risk plant species, so monitoring would be needed to determine the impacts of project activities and management direction.

Information Sources

Primary information sources for at-risk plant species and their occurrences on the Custer Gallatin are the Montana and South Dakota Natural Heritage Program Element Occurrence databases and online Montana Field Guide, NatureServe database, Rocky Mountain Herbaria and the Consortium of Pacific Northwest Herbaria. For some species, threat category information was provided by the Montana Native Plant Society. NatureServe, and the Montana and South Dakota Natural Heritage Programs provide rankings that categorize the risks to persistence associated with each species they evaluate. These rankings, along with the other criteria in Forest Service Handbook 1909.12, Chapter 10, section 12.52, were used to develop the list of species of conservation concern for the Custer Gallatin. The Rocky Mountain Herbaria and Consortium of Pacific Northwest Herbaria online databases provided distribution and habitat information. Various floristic surveys for the Custer Gallatin were used to help determine which plant species to consider as at-risk species. Three recent Rocky Mountain Herbarium floristic surveys (Hartman and Nelson 2010, Hallman 2012, Elliott 2014) added to the species to consider for the Custer Gallatin National Forest.

The majority of at-risk plant species that are not federally listed do not have the same level of scientific data available as federally listed species. Though there may be uncertainties and gaps in data and knowledge about at-risk plant species, the best available information is utilized in this analysis to assess the condition and determine potential effects between alternatives.

There is little published information about most at-risk plant species concerning their persistence, biology, habitat, population dynamics, and occurrences. Information gaps relevant to at-risk species may be filled in through future inventories, plan monitoring results, or research, and this information would be integrated into the databases and Regional Forester’s species of conservation concern lists as it becomes available.

Analysis Area

The geographic scope of the analysis for effects to at-risk plant species is the lands administered by the Custer Gallatin National Forest. Some attributes are summarized at large scales to provide context. However, some ecosystem components are described at a more localized scale due to their ecological importance and limited distribution. The specific range of each at-risk species may extend beyond the national forest boundary; however, the lands administered by the Custer Gallatin represent the area where changes may occur to these species or their habitats from activities that might be allowed under the alternatives. In some cases, the best available scientific information for at-risk species’ ecological relationships originated outside the analysis area. The full range of each species was considered to evaluate the persistence and importance of each species’ habitat on the national forest, but only indicator measurements from within the analysis area were used in making conclusions. Cumulative effects consider neighboring tribal, Federal, State land jurisdictions. The temporal scope of the analysis is the anticipated life of the plan.

3.5.2 Affected Environment (Existing Condition)

Regional Forester's Sensitive Plant Species

Regional Forester's sensitive species are defined as "Those plant and animal species identified by a Regional Forester for which population viability is a concern, as evidenced by: significant current or predicted downward trends in population numbers or density; or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution." The current Northern Regional Forester's sensitive plant species list was developed in 2011. Suitable habitat for 31 currently listed Regional Forester's sensitive plant species exists on the Custer Gallatin National Forest. Twenty-four of the 31 have known populations occur on the national forest (125 occurrences) and seven species are not known, but are suspected to occur. Upon final Regional Forester's determination of the Custer Gallatin's Plant Species of Conservation Concern list, the list will be replaced with the species of conservation concern list. Analysis of sensitive plant species pertain to the current plans. Appendix C provides the Regional Forester's sensitive species list.

Federally Listed At-Risk Plant Species

Species federally listed as threatened or endangered, proposed, and candidate are designated by the United States Department of the Interior, U.S. Fish and Wildlife Service. Under provisions of the Endangered Species Act of 1973, Federal agencies are directed to conserve endangered and threatened species and to ensure that actions authorized, funded, or carried out by these agencies are not likely to jeopardize the continued existence of threatened or endangered species, or result in the destruction or adverse modification of their critical habitats. These species are automatically considered "at-risk" species under the 2012 Planning Rule.

There are no endangered plant species known on the Custer Gallatin National Forest. Whitebark pine (*Pinus albicaulis*), is a candidate species for Federal listing as threatened, due to sufficient information on its biological status and threats.

Whitebark pine is considered both a foundation and a keystone species. A keystone species is a species that has a disproportionately large effect on its environment relative to its abundance. As a foundation species it plays an ecological role in defining ecosystem structure, function, and process (Tomback 2009). Whitebark pine is often the first colonizer on high elevation sites with difficult growing conditions (high snow loads, poor soil development, and short growing seasons). Whitebark pine plays a role in regulating soil development, carbon storage, and capturing and retaining snow, which increases the quantity and duration of summer runoff. This lengthened snow melt provides water to feed streams and riparian communities longer into the growing season (Keane et al. 2017). Whitebark pine has a large protein rich seed that is an important food source for birds, squirrels, black and grizzly bears, and other mammals. Because of their size seeds are not wind disseminated and it relies almost exclusively on Clark's nutcrackers for seed dispersal (Keane et al. 2017).

Whitebark pine is a slow-growing, long-lived tree of the high mountains of southwestern Canada and western United States. It is of limited commercial use, but it is valued for watershed protection and aesthetics. The whitebark pine cover type occurs at the high elevations, commonly on the Cold Forest habitat guild (where it is perpetuated by disturbance) or Cold Timberline habitat guild (where it is the most common dominant). Minor components of subalpine fir, spruce, or lodgepole pine may occur. Whitebark is a shade intolerant, moderately fire resistant species.

Based on forest inventory and analysis data, whitebark pine is present on approximately 420,000 acres on the Custer Gallatin National Forest. Whitebark pine is found within the Madison, Henrys Lake, Gallatin Mountains, Bridger, Bangtail, Crazy, and Absaroka Beartooth Mountains Geographic Areas. Whitebark pine does not occur on the Sioux, Ashland, or Pryor Mountains Geographic Areas. The largest extent of whitebark pine occurs on the Madison, Henrys Lake, Gallatin, and Absaroka Beartooth Geographic Areas on about 390,270 acres (20 percent of the analysis area). The Bridger, Bangtail, and Crazy Mountains Geographic Areas have about 30,150 acres with whitebark pine present (16 percent of the analysis area). On a broader landscape, whitebark pine is found on 10 percent or 2.5 million acres of the 24-million-acre Greater Yellowstone Area (Greater Yellowstone Coordinating Committee Whitebark Pine Subcommittee 2011). Whitebark pine conservation ranks are G3G4, S3 in Montana, a Regional Forester's sensitive species, and a U.S. Fish and Wildlife Service federal candidate species. It occurs in the Cold Forest habitat guild in subalpine forests and at timberline.

A petition went out in 2008 to list whitebark pine under the Endangered Species Act. The U.S. Fish and Wildlife Service conducted a 12-month status review (USDI FWS 2011). The finding, published on July 19, 2011 (FR 76[138]: 42631-42654), determined that listing the species under the Endangered Species Act is warranted, but precluded by higher priority listing actions. In August of 2011, the Northern Region designated whitebark pine as a sensitive species (Weldon 2011). As a result, whitebark pine is a candidate species and the U.S. Fish and Wildlife Service has assigned it a listing priority number of 8, indicating the threats are imminent and of moderate to low magnitude (USDI FWS 2015a).

The findings in the status review identified interrelated threats to whitebark pine and the long-term persistence of whitebark pine ecosystems (USDI FWS 2011) and are relevant to the Custer Gallatin National Forest. These factors include the following:

- Fire Suppression: After a century of suppression, many whitebark stands are experiencing a species conversion to shade-tolerant trees, and a lack of suitable seedbeds for regeneration. The balance of a natural fire regime with related vegetative succession processes has been disrupted, and as a result whitebark pine has lost its competitive advantage (USDI FWS 2011).
- Climate Change: In a warmer climate, the species' fundamental habitat may shift to cooler sites at higher elevations and latitudes. Recent studies indicate that whitebark pine is one of the most vulnerable tree species in the northern Rocky Mountains to climate change (Hansen and Phillips 2015). Climate suitability is projected to decline dramatically by the end of the century and the adaptive capacity of whitebark pine is thought to be relatively low because dispersal is fairly limited, it is often outcompeted by other subalpine conifers, and it is highly susceptible to mountain pine beetle and blister rust (Hansen and Phillips 2015). Genetic studies indicate high levels of variation within and among geographic zones across the species range. This variation could be advantageous under changing climate conditions (Mahalovich and Hipkins 2011).
- White Pine Blister Rust: White pine blister rust (*Cronartium ribicola*) is an exotic fungal disease against which whitebark has limited resistance. Since blister rust was introduced to North America in 1910, it has spread through the range of five-needled pines. As this disease has moved into fragile, high-elevation ecosystems, normal successional pathways have been altered. Blister rust typically

infects nearly all individuals of the host species, causing branch and stem cankers in trees that eventually kill most trees. However, some trees show resistance.

- Mountain Pine Beetle: Five-needled pines are susceptible to this aggressive bark beetle. In densely stocked stands, whitebark is more likely to be attacked because of stress from competition. Mountain pine beetle accelerates the loss of key mature cone-bearing trees.

The U.S. Fish and Wildlife Service has concluded that there is an ongoing pattern of substantial decline of whitebark pine on the majority of its range (USDI FWS 2011). The abundance of the whitebark pine cover type on the Custer Gallatin National Forest is below the natural range of variation. In contrast, the overall presence of whitebark pine is within the natural range of variation, though at the low end.

The loss of whitebark has dramatically altered the structure, composition, and pattern of high-elevation ecosystems, and threatened their long-term stability and integrity. This impacts hydrological processes and wildlife habitat values. Whitebark pine in the greater Yellowstone ecosystem has also been impacted by white pine blister rust: infection rates were estimated at 14 to 26 percent at the end of 2015 (Shanahan et al. 2017). Restoration activities are needed to address the threats to whitebark pine (USDI FWS 2011). The amount of whitebark that are resistant to blister rust may increase slowly through the process of natural selection, if they are given a chance to regenerate (Hoff et al. 2001).

Between 2004 and 2009, approximately 80 percent of large size class whitebark pine in the greater ecosystem were killed by an epidemic of mountain pine beetle (Shanahan et al. 2016). The impacts were due primarily to temperature release on beetle development and weak defense mechanisms of whitebark pine that did not co-evolve with mountain pine beetle (Raffa et al. 2013). Almost the entire range of whitebark pine in the greater Yellowstone ecosystem was affected by mountain pine beetle during this epidemic and approximately 50 percent of the area showed severe mortality, and 36 percent moderate mortality as indicated by the change in overstory condition (Macfarlane et al. 2013).

Both climate suitability models and mechanistic models project substantial reductions in area of suitable habitat and loss of larger size classes in the Greater Yellowstone Ecosystem (Chang et al. 2014, Ireland et al. 2018). In association with warming temperatures, bark beetle outbreaks are projected to increase in future decades (Buotte et al. 2016). Pine blister rust is also expected to inflict increased mortality on whitebark pine under a warming climate (Keane et al. 2017).

There is very high uncertainty in projections of whitebark pine under future climates in the greater Yellowstone ecosystem because the tolerances of the species to warm and dry conditions are not known. One perspective is that the species can tolerate the warmer drier conditions at lower elevations but is limited there by competition with other conifers (Hansen et al. 2016). Another perspective is that it is limited to moister soil conditions for regeneration (Chang et al. 2014).

While a decline of whitebark pine is predicted to occur under future climate scenarios, restoration actions such as planting rust resistant seedlings and employing other strategies such as protection from mountain pine beetle and thinning treatments to reduce competition and fire intensity may help to slow this decline (Keane et al. 2017). A number of efforts are underway to improve upon where to plant whitebark pine and will take into consideration both macro and micro-refugia (Shanahan et al. 2017, Mahalovich et al. 2018). These refugia sites take into consideration climate and site characteristic (that is, aspect, soils, slope, and elevation) interactions at specific locations on the ground to improve tree survival (resilience and persistence). Matching genetic resources to sites projected to support whitebark pine in future climates would ensure species persistence and provide important wildlife food into the future (Mahalovich et al. 2016).

In response to the current situation in whitebark ecosystems, the Greater Yellowstone Coordinating Committee's Whitebark Pine Subcommittee, which has worked successfully across boundaries since its inception in 2000, developed a whitebark pine strategy to promote the persistence over time and space in the Greater Yellowstone Area by: documenting the current condition of whitebark pine in the Greater Yellowstone Area; establishing criteria to prioritize areas for management action; identifying techniques and guidelines to protect and restore whitebark pine; and facilitating communication and distribution of this information. This strategy is intended to enable land management units to maximize the use of their limited resources to maintain the presence of whitebark pine in the Greater Yellowstone Area (Greater Yellowstone Coordinating Committee Whitebark Pine Subcommittee 2011).

At-Risk Plant Species of Conservation Concern

Under the 2012 Planning Rule, in addition to federally listed species, plant species at-risk on the Custer Gallatin includes species of conservation concern designated by the Regional Forester of the Northern Region where best available scientific information indicates "substantial concern about the species' capability to persist over the long term in the plan area" (36 CFR 219.9; FSH 1909.12 Chapter 10, part 12.52).

The process for identifying these species and the listed species of conservation concern for the Custer Gallatin are located on the Region 1 Species of Conservation Concern web page. State conservation rankings, along with the other criteria in Forest Service Handbook 1909.12, Chapter 10, section 12.52 and chapter 20, section 21.22a, were used to develop the Regional Forester's at-risk plant species list for the Custer Gallatin National Forest. Using NatureServe, Montana Natural Heritage Program (MTNHP), South Dakota Natural Heritage Program databases, the current Regional Forester sensitive species list, and publications, a master list of State plant species of concern (for both Montana and South Dakota) known or suspected to occur on the Custer Gallatin National Forest was compiled for initial assessment (consisting of 152 species). Of these 152, 40 were determined to be outside the national forest, leaving 112 species known on the Custer Gallatin to be evaluated. Twenty-five plant species were determined by the Regional Forester to be species of conservation concern.

The final plant species of conservation concern list will replace the sensitive plant species list for the Custer Gallatin National Forest. The identification of species of conservation concern is dynamic and may change over time, as with the Regional Forester sensitive species list. Table 26 lists the plant species that are currently determined to be species of conservation concern by the Regional Forester on the Custer Gallatin National Forest. In addition, information regarding the rationale for identifying these species as species of conservation concern can be found on the Region 1 Species of Conservation Concern web page. See note at bottom of table for interpretation of conservation category codes.

Table 26. At-risk plant species of conservation concern

Name and General Geographic Area	Conservation Categories[1]	Habitat Guild, Distribution, and Abundance in the Plan Area
muskroot *Adoxa moschatellina* (Montane & Pine Savanna)	G3 S3 – MT; S4 - SD SOC - MT, RFSS, SCC	Sparsely Vegetated: Rock / talus; cold air flow channels beneath rock slides. Four occurrences in the Absaroka Beartooth Geographic Area (three within the Beartooth RD and one within the Yellowstone RD (MTNHP 2018 GIS Dataset)).

Name and General Geographic Area	Conservation Categories[1]	Habitat Guild, Distribution, and Abundance in the Plan Area
oval-leaf milkweed *Asclepias ovalifolia* (Pine Savanna)	G5; S1S2 - MT; SOC - MT; RFSS; SCC	Grassland/Shrubland: Sandy, gravelly or clayey soils of prairies and woodlands. Ten occurrences in the Sioux Geographic Area (MTNHP 2018 GIS Dataset; Heidel and Dueholm 1995; Hansen, 2018).
narrowleaf milkweed *Asclepias stenophylla* (Pine Savanna)	G4G5; S2 - MT; SOC – MT; SCC	Grassland/Shrubland: Sandy sites on the prairie. Four occurrences on the Custer Gallatin; three occurrences in the Sioux Geographic Area and one occurrence in the Ashland Geographic Area (MTNHP 2018 GIS Dataset; Heidel and Dueholm 1995; Reid and Hallman 2010).
Frenchman's Bluff moonwort *Botrychium gallicomontanum* (Montane & Pine Savanna)	G1G2; S1S2 - MT; S1 - SD SOC - MT; SOC – SD; SCC	Grassland/Shrubland: Valley grassland, foothill, lower and upper montane, and subalpine. One occurrence in the Absaroka Beartooth Geographic Area within the Yellowstone RD (Elliot 2014, MTNHP 2018 GIS Dataset).
Peculiar moonwort *Botrychium paradoxum* (Montane)	G3; SOC - MT, RFSS; SCC	Grassland/Shrubland: Meadows (mesic montane/subalpine). One occurrence in the Absaroka Beartooth Geographic Area within the Yellowstone RD (MTNHP 2018 GIS Dataset, Elliot 9009, Elliot 2014)
annual Indian paintbrush *Castilleja exilis* (Montane)	G5; S2 - MT; SOC - MT	Grassland/Shrubland: Moist alkaline meadows in valleys. One occurrence in the Absaroka Beartooth Geographic Area within the Yellowstone RD (MTNHP 2018 GIS Dataset).
heavy sedge *Carex gravida var. gravida* (Pine Savanna)	G5; S3 - MT; SOC - MT; RFSS; SCC	Broadleaf Woodlands: Mesic/humid open woods, often in ravines with deciduous trees, on the plains. 37 occurrences in the Ashland and Sioux Geographic Areas (MTNHP 2018 GIS Dataset, SDNHP 2016 dataset,Hallman 2012, Lesica and Marlow 2013).
small yellow lady's-slipper *Cypripedium parviflorum* (Montane & Pine Savanna)	G5; S3? - SD; S3S4 - MT; SOC - SD PSOC - MT RFSS; SCC	Wetland and riparian: Damp, mossy woods; seeps, moist forest meadows; fens; valley to lower montane. One occurrence in the Sioux Geographic Area. Three historic occurrences in the Absaroka Beartooth Geographic Area (MTNHP 2018 GIS Dataset, Mergen 2006, Hallman 2012, Hansen, 2009).
Dense-leaf draba *Draba densifolia* (Montane)	G5; S2 - MT; SOC - MT; SCC	Sparsely Vegetated: Gravelly, open soil of rocky slopes and exposed ridges in montane to alpine zones. Two occurrences in the Absaroka Beartooth Geographic Area within the Yellowstone RD (MTNHP 2018 GIS Dataset, Elliott 2014).
English sundew *Drosera anglica* (Montane)	G5; S3 - MT; SOC - MT RFSS; SCC	Wetland and riparian: Floating bogs, swamps, and sedge meadows, with soils that are saturated or in very shallow standing water; weakly acidic or calcareous bogs and fens. One occurrence in the Absaroka Beartooth Geographic Area within the Gardiner RD and one historic occurrence in the Gallatin, Madison, Henrys Lake Geographic Area within the Bozeman RD (MTNHP 2018 GIS Dataset,Lesica and Shelly 1991, Wolf et al. 2006, Elliott 2014).

Name and General Geographic Area	Conservation Categories[1]	Habitat Guild, Distribution, and Abundance in the Plan Area
beaked spikerush *Eleocharis rostellata* (Montane & Pine Savanna)	G5; S1 - SD; S3 - MT; SOC - SD SOC - MT RFSS; SCC	Wetland and riparian: Wet, often alkaline soils, associated with warm springs or fens in the valley and foothill zones. Two occurrences in the Absaroka Beartooth Geographic Area within the Yellowstone and Gardiner RDs (MTNHP 2018 GIS Dataset).
Whitestem Goldenbush *Ericameria discoidea var. discoidea* (Montane)	G4G5T4; S2 - MT; SOC - MT; RFSS; SCC	Sparsely Vegetated: Rocky, open sparsely wooded slopes or coarse talus near or above tree line. One occurrence in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area within the Hebgen Lake RD (MTNHP 2018 GIS Dataset).
Dakota buckwheat *Eriogonum visheri* *(Pine Savanna)*	G3; S2 - MT; S3 - SD; SOC - MT; SOC - SD ; RFSS; SCC	Sparsely Vegetated: Badlands, clay barrens, often bentonitic badland slopes and outwashes in the plains. One occurrence in the Sioux Geographic Area (SDNHP 2016 Dataset, Heidel and Dueholm 1995).
hiker's gentian *Gentianopsis simplex* (Montane)	G5; S2 - MT; SOC - MT; RFSS; SCC	Wetland and riparian: Fens, wet meadows, seeps. Twelve occurrences in the Absaroka Beartooth and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas within the Beartooth/Yellowstone RDs and Bozeman RD, respectively (MTNHP 2018 GIS Dataset, Shelly 1994, Elliott 2014, Clark 2017).
spiny hopsage *Grayia spinosa* (Montane)	G5; S2 - MT; SOC – MT; SCC	Grassland/Shrubland: One occurrence in the Absaroka Beartooth Geographic Area within the Gardiner RD (MTNHP 2018 GIS Dataset).
rockyscree false goldenaster *Heterotheca fulcrata* (Montane)	G4G5; Not yet ranked in MT; SCC	Sparsely Vegetated: Limestone outcrops. One occurrence in the Absaroka Beartooth Geographic Area within the Beartooth RD (MTNHP 2018 GIS Dataset, Elliott 2014)
Nuttall Desert-Parsley (*Lomatium nuttallii)* (Pine Savanna)	G3; S2 - MT; SH - SD; SOC - MT; SOC - SD ; RFSS; SCC	Sparsely Vegetated: Rocky, open pine woodlands; mid to lower hillslopes on sandstone, siltstone, or clayery shale. Four occurrences in the Ashland Geographic Area (MTNHP 2018 GIS Dataset, Barton and Crispin 2003).
meesia moss (*Meesia triquetra)* (Montane)	G5; S2 - MT; SOC - MT; RFSS; SCC	Wetland and riparian: Bogs, wetlands, and wet woods. One occurrence in the Absaroka Beartooth Geographic Area within the Beartooth RD (MTNHP 2018 GIS Dataset).
dwarf purple monkeyflower (*Mimulus nanus)* (Montane)	G5; S2S3 - MT; MT SOC; RFSS; SCC	Sparsely Vegetated: Open slopes (low elevation); dry, often gravelly or sandy slopes in the valleys and foothills. Four occurrences in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area within the Hebgen Lake RD (MTNHP 2018 GIS Dataset, Elliott 2014).
wooly twinpod (*Physaria didymocarpa var. lanata*) (Montane and Pine Savanna)	G5T2; S2S3 - MT SOC – MT; SCC	Sparsely Vegetated: Sandy, often calcareous soil of open grassland or shrubland slopes in the plains. Three occurrences in the Absaroka Beartooth Geographic Area within the Beartooth and Yellowstone RDs (MTNHP 2018 GIS Dataset, Elliott 2014).

Name and General Geographic Area	Conservation Categories[1]	Habitat Guild, Distribution, and Abundance in the Plan Area
Beartooth large-flowered goldenweed (*Pyrrocoma carthamoides var. subsquarrosus*) (Montane)	G4G5T3; S3 - MT; SOC - MT; RFSS; SCC	Grassland/Shrubland: Grassland and sagebrush habitat; soils tend to be moderately deep, sandy, and high in coarse fragments. Eighteen occurrences in the Absaroka Beartooth and Pryor Mountains Geographic Areas within the Beartooth RD (MTNHP 2018 GIS Dataset, Lesica and Montana National Heritage Program 1995, Handley and Laursen 2002, Beatty et al. 2004).
Barratt's willow (*Salix barrattiana)* (Montane)	G5; S2 - MT; SOC - MT; RFSS; SCC	Alpine: Cold, moist soil in the alpine zone. Two occurrences in the Absaroka Beartooth Geographic Area within the Beartooth RD (MTNHP 2018 GIS Dataset, Lesica 1993, Fertig and Markow 2000) Ladyman, 2005).
Shoshonea (Shoshonea pulvinata) (Montane)	G2G3; S2 - MT; SOC - MT RFSS; SCC	Sparsely Vegetated: Open, exposed limestone outcrops, ridgetops, and canyon rims, in thin rocky soils. Six occurrences in the Pryor Mountains Geographic Area and one in the Absaroka Beartooth Geographic Area) within the Beartooth RD (MTNHP 2018 GIS Dataset, Lyman 2005, Heidel 2011, 1988; (Lesica and Achuff 1992).
Oregon checker-mallow (*Sidalcea oregana)* (Montane)	G5; S2S3; SOC – MT; SCC	Grassland/Shrubland: Grasslands in the valley and montane zones. Two occurrences in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area within the Bozeman RD (MTNHP 2018 GIS Dataset, Vanderhorst 1994).
northwestern thelypody (*Thelypodium paniculatum)* (Montane)	G2; SH - MT; SOC - MT; SCC	Wetland and riparian: Moist alkaline meadows. One occurrence in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area within the Hebgen Lake RD (MTNHP 2018 GIS Dataset, Elliott 2014).

1. SCC = Species of conservaton concern, RD = Ranger District, RFSS = Regional Forester Sensitive Species, SOC = State Species of Concern, Sx - MT = Montana species of concern state ranking; Sx - SD = South Dakota species of concern state ranking; Gx = Global ranking

At-Risk Plant Species by Habitat Guild

All at-risk plant species were grouped into species broad habitat guilds (habitat type groupings), based on similar ecological conditions, response to disturbances, and habitat needs for the purpose of identifying and evaluating relevant information about them. These groupings were made based on the ecological conditions necessary to support long-term persistence of associated at-risk plant species. Though there may be variation in specific habitat needs for species within a habitat guild, the potential stressors and associated conservation strategies for the species in the habitat guilds would be very similar. This allows for more efficient analysis and identification of relevant information pertaining to the species.

The 26 at-risk plant species (25 plant species of conservation concern and one Federal candidate species) include one alpine species, one cold forest species, one broadleaf woodland species, eight grassland or shrubland species, nine sparse vegetation species, and six riparian or wetland species. Of the 26 total at-risk species, 16 of the species' habitat components are likely to only occur in the montane areas of the Custer Gallatin (Madison, Henrys Lake, and Gallatin Mountains, Absaroka-Beartooth, Bridger, Bangtail, Crazy Mountains, and Pryor Mountains Geographic Areas), five of the species' habitat components are likely to only occur in the pine savanna areas (Ashland and Sioux Geographic Areas), and five species' habitat components could occur in both the montane and pine savanna areas (*Adoxa moschatellina*, *Botrychium gallicomontanaum*, *Cypripedium parviflorum*, *Eleocharis rostellata,* and *Physaria didymocarpa* var. *lanata*).

Cold Forest Habitat Guild

Whitebark pine is an at-risk plant found within this habitat.

The cold forest habitat guild is where the highest elevation subalpine fir and lodgepole pine climax types occur and where whitebark pine may be present with lodgepole pine, subalpine fir, and Engelmann spruce. At timberline, whitebark pine is usually both the existing and climax vegetation because these types are above the cold limits of most other species. Whitebark pine would be favored with a natural fire regime. Most natural fires were low severity because of discontinuous fuels, although high severity occurred at long intervals. The natural fire regime was variable including low and mixed severity (generally 35 to 300+ year intervals) as well as stand-replacing fires at long intervals. Of the montane units, 29 percent are classified as cold forest cover types.

Stressors and ecological processes that influence cold forested habitats include vegetation treatments (such as logging and wildland fire), fire disturbances and fire exclusion or suppression, natural succession, construction of roads and other developments, mining activities, recreational activities (such as trails), camping and off road vehicle use (that could disturb or trample plants), and invasive plant species and treatment of infestations.

Whitebark pine: In the cold forest habitat guild, whitebark pine has been declining rapidly from the combined effects of native mountain pine beetle outbreaks, fire exclusion, and the spread of the exotic white-pine blister rust. This is of major concern because whitebark pine is both a keystone species, because it supports unique community diversity, and a foundation species because of its roles in promoting community development and stability. Because their large size seeds are not wind disseminated, it relies almost exclusively on Clark's nutcrackers for seed dispersal. Within the last decade, major outbreaks of pine beetle and increasing damage and mortality from blister rust have resulted in cumulative whitebark pine losses that have altered high-elevation community composition and ecosystem processes.

Alpine Habitat Guild

Barratt's willow (*Salix barrattiana*) is an at-risk plant found within this habitat. There are two occurrences of Barratt's willow in the Absaroka Beartooth Geographic Area.

Alpine communities are common in the high elevations of the montane units of the Custer Gallatin National Forest. Approximately 121,000 acres of alpine vegetation occurs within the National Forest System lands of the Custer Gallatin. The Beartooth Mountains are primarily composed of the largest expanse of alpine plateau in the lower 48 states. The alpine vegetation is dominated by various grasses, sedges, small shrubs, and forbs that are able to withstand the severe environment characterized by high winds, low humidity, cold soil temperatures, high ultraviolet radiation, short growing season, low soil moisture, and great daily temperature fluctuations.

Alpine habitats are often fragile systems due to limited growing season and soil development. Although recreation and road construction are threats to rocky habitats, disturbance is often limited due to inaccessibility. Radio structures, mining, trail construction, and recreation are the main management related disturbances. Changes in fire patterns and severities, and associated effects on vegetation succession may be a stressor in some environments. Improper grazing has the potential to negatively impact these habitats, but permitted grazing rarely occurs in these habitats as most allotments do not contain accessible alpine areas. Elevation will play a large role in plant species composition in conjunction with predicted warming trends. High elevation, alpine or other fringe type environments may see plant species composition change first. Invasive plants apparently have not yet become a serious problem in the alpine settings of the Custer Gallatin National Forest, although yellow toadflax and Canada thistle are present above 9000 feet and have the potential to invade such areas in the future.

Barratt's willow (*Salix barrattiana*) montane: This alpine species is at the southern extent of the species' distribution and is largely confined to the designated Line Creek Plateau Research Natural Area on the Custer Gallatin (MTNHP 2018; Lesica 1993). The two occurrences on are small, but the remote, high-elevation habitat should greatly minimize the potential for any negative impacts to the persistence of the *Salix barrattiana.* One occurrence, encompassing about 100 square meters (Ladyman 2005), straddles the land managed by the Custer Gallatin and Shoshone National Forests and consists of a single clone of staminate (male) plants (Fertig and Markow 2000). In this case, no sexual reproduction can occur, and the population must rely on asexual vegetative reproduction. Notwithstanding the absence of sexual reproduction, populations of vegetatively propagated individuals can be very successful (Ladyman 2005). Associated species with the occurrences includes *Salix glauca* and *S. planifolia* found at 9700' elevation. The occurrences on the Custer Gallatin appear to be stable, at least in the short term. However, there is no information on which to evaluate trends in abundance for the population (Ladyman 2005). While the bulk of known occurrences of this species are distributed in Canada and Alaska, one occurrence is known from Glacier National Park (Montana Natural Heritage Program online accessed 2018); two occurrences are known on the Shoshone National Forest (Rocky Mountain Online Herbaria accessed 2018), and one occurrence in Madison County, Montana (Consortium of Pacific Northwest Herbaria, accessed online 2018). No additional populations of *Salix barrattiana* have been located despite a recent floristic survey of wetlands within its range in Montana (Jones 2001).

Broadleaf Woodlands Habitat Guild

Heavy sedge (*Carex gravida var. gravida -* 37 occurrences of heavy sedge in the Ashland and Sioux Geographic Areas) is an at-risk plant found within this habitat guild.

Deciduous broadleaf woodlands in mesic settings include green ash woodlands in the Ashland and Sioux Geographic Areas, which provide habitat for heavy sedge. Green ash woodlands are best developed under conditions that favor snow entrapment, development of deeper soils, and concentration of moisture. These conditions are typical of ravines formed by ephemeral and intermittent streams where flooding is more sporadic or of short duration. Uplands are generally mixed grass prairies, shrublands and ponderosa pine forest. Soils are usually deep loams. Flooding is very short in duration when it occurs, as water is rapidly channeled downslope.

Threats to broadleaf woodlands include fire suppression, improper grazing, noxious species invasion, conifer colonization, and human activity. There may be loss of tree species to disease, insects, freezes, and fire as well as shifts in warming or drying patterns as a result of climate change which may be beneficial to some species.

Heavy sedge (*Carex gravida var. gravida*) – Pine Savanna: In general, heavy sedge has been found at a few widely scattered locations in eastern Montana, and is not generally abundant where it occurs. This species is restricted to limited habitat that occurs at the western extent of its range where degree of humidity may be limited. This species and habitat type is vulnerable to improper grazing and weed invasion.

Grassland and Shrubland Habitat Guild

Oval-leaf milkweed (*Asclepias ovalifolia* - ten occurrences in the Sioux Geographic Area), narrowleaf milkweed (*Asclepias stenophylla* - three occurrences in the Sioux Geographic Area and one occurrence in the Ashland Geographic Area), Frenchman's Bluff moonwort (*Botrychium gallicomontanum* - one occurrence in the Absaroka Beartooth Geographic Area), peculiar moonwort (*Botrychium paradoxum* - one occurrence in the Absaroka Beartooth Geographic Area), annual Indian paintbrush (*Castilleja exilis* - one occurrence in the Absaroka Beartooth Geographic Area), spiny hopsage (*Grayia spinosa* - one occurrence in the Absaroka Beartooth Geographic Area), Beartooth large-flowered goldenweed (*Pyrrocoma carthamoides* var. *subsquarrosus* -18 occurrences in the Absaroka Beartooth and Pryor Mountains Geographic Areas) and Oregon checker-mallow (*Sidalcea oregana* - two occurrences in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area) are at-risk plants found within this habitat guild.

Grasslands are dominated by cool-season perennial bunchgrasses and forbs, with sparse shrub or tree representation. Some warm-season grass occurs on the Ashland and Sioux Districts. Grasslands are usually forb species rich and may vary by moisture regime. Various shrub species may occur with low cover. Scattered pockets of ponderosa pine, limber pine, and Rocky Mountain juniper occur on shallow, skeletal soils or resistant bedrock. Grasslands range in size from small patches to large open parks, from montane to foothill zones.

Mesic meadow grassland habitats occur at lower montane to subalpine elevations where soils, snow deposition, or windy conditions limit tree growth. Meadow habitats are generally moist, sometimes seasonally so and may dry up late in the summer. Meadows occur in mosaics with shrublands or forests, or are adjacent to alpine communities across the Custer Gallatin. They are generally dominated by perennial graminoids and mesic forbs. Scattered shrubs or trees may be present, but are not abundant. These meadows are limited on the landscape and occupy fringe habitats adjacent to wetter meadows or forest swales.

Shrublands occurs at all slopes, aspects, and soil types, on the Custer Gallatin. The community can exhibit a variable extent of shrub diversity but is typically dominated by mountain or Wyoming big sagebrush. In some areas of volcanic origin, antelope bitterbrush may be co-dominant. The understory is often high in perennial bunchgrass and forb species diversity. Moist shrublands include shrubby cinquefoil, snowberry, birch, and willow.

General threats to grasslands and shrublands include fire suppression, improper grazing, off-road vehicle use, noxious species invasion, conifer encroachment, off-trail recreation (for example, all-terrain vehicles, bicycles) and human development. Warming trends may also contribute to changes in the shrub communities as fire frequency intervals and fire intensities change. In the absence of natural fire and periodic prescribed burns, appropriate grazing management practices can be used to maintain this system. The spread of nonnative grass species has reduced native species diversity in all geographic areas on the Custer Gallatin National Forest.

All at-risk plant occurrences in this habitat guild are vulnerable to weed invasion. Beartooth large-flowered goldenweed is also vulnerable to competition and shading from conifer encroachment.

Sparsely Vegetated Habitat Guild (talus, scree, rocky, exposed, badlands)

Muskroot (*Adoxa moschatellina* - four occurrences in the Absaroka Beartooth Geographic Area), denseleaf draba (*Draba densifolia* - two occurrences in the Absaroka Beartooth Geographic Area), whitestem goldenbush; (*Ericameria discoidea var. discoidea* - one occurrence in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area), Dakota buckwheat (*Eriogonum visheri* - one occurrence in the Sioux Geographic Area), rockyscree false goldenaster (*Heterotheca fulcrata* - one occurrence in the Absaroka Beartooth Geographic Area), Nuttall desert-parsley (*Lomatium nuttallii* - four occurrences in the Ashland Geographic Area), dwarf purple monkeyflower (*Mimulus nanus* - four occurrences in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area), wooly twinpod (*Physaria didymocarpa var. lanata* - three occurrences in the Absaroka Beartooth Geographic Area), and Shoshonea (*Shoshonea pulvinata* - six occurrences in the Pryor Mountains Geographic Area and one in the Absaroka Beartooth Geographic Area) are at-risk plants found within this habitat guild.

Sparsely vegetated areas are often described as talus, rocky sites, disturbed sites, exposed sites, or badlands. This setting occupies the fringes of adjacent systems, particularly dry habitats. Tree and herbaceous cover is often low due to limited soil development and dry growing conditions, site disturbance, or rocky conditions. This habitat includes natural rock outcrops as well as scree (that is, talus) and covers a wide range of rock types, varying from acidic to highly calcareous. Bryophytes and lichens often occur in crevices and flourish on open rock surfaces where the competition from vascular plants is absent. Species composition can vary widely, depending on the moisture regime and adjacent communities contributing to the seed source.

Sparsely vegetated habitats are often fragile systems. Although recreation and road construction are threats to these habitats, disturbance is often limited due to inaccessibility in the montane areas. Threats to the sparsely vegetated habitats in the pine savanna areas include weed invasion, trampling from grazing, , off-road vehicle use, off-trail recreation (that is, all-terrain vehicles and bicycles), oil, gas, and mineral exploration or extraction, and shifts in warming or drying patterns. Shifts in warming or drying trends may also contribute to a change in range and distribution of plant species.

Muskroot (*Adoxa moschatellina*) – montane and pine savanna: Occurrences are generally small in specialized microhabitat. Though they occur in habitats not generally impacted by human disturbance or invasive weeds, building and use of trails may potentially impact known occurrences.

Denseleaf draba (*Draba densifolia*) – montane: This species occurrence on the Custer Gallatin is on the eastern edge of its range. The Iron Mountain site may be vulnerable to mineral related activities on the national forest.

Whitestem goldenbush (*Ericameria discoidea var. discoidea*) – montane: The one occurrence is vulnerable to improper livestock grazing and weed invasion.

Dakota buckwheat (*Eriogonum visheri*) – pine savanna: This species is a regional endemic. This population grows on sparsely vegetated alluvial outwash in badlands topography and does not appear to be threatened by weeds, livestock grazing, or other activities at this time. This location is potentially vulnerable to livestock trailing.

Rockyscree false goldenaster (*Heterotheca fulcrata*) – montane: This location may be vulnerable to recreational impacts near the developed Nye Picnic Area.

Nuttall desert-parsley (*Lomatium nuttallii*) – pine savanna: This occurrence is disjunct from other main occurrences to the south. This species of is of cultural interest; locally collected by tribal members in very limited amounts and infrequently. This location is vulnerable to weed invasion.

Dwarf purple monkeyflower (*Mimulus nanus*) – montane: Four occurrences of dwarf purple monkeyflower are documented on the Hebgen Lake District. Habitat is vulnerable to weed invasion, potential recreation use, and bison management activities.

Wooly twinpod (*Physaria didymocarpa var. lanata*) – montane and pine savanna: The Custer Gallatin occurrences are disjunct from Bighorn County, Montana populations. These occurrences are vulnerable to weed invasion.

Shoshonea (*Shoshonea pulvinata*) – montane: This species is a regional endemic to the foothills (Absaroka and Owl Creek Mountains of northwest Wyoming and adjacent Montana) flanking the Bighorn Basin with a global distribution limited to 12 occurrences. Six of these 12 occurrences are located on Custer Gallatin. Occurrences are composed of mats that are comprised of hundreds or even thousands of individual plants. The total number of plants is estimated to be 12,000 in Montana (Lyman 2005). This species is restricted to relatively barren, calcareous soils, but locally abundant on these sites. The occurrences are vulnerable to regional stochastic (random) events. Some occurrences may be vulnerable to trampling by wild horses.

Riparian and Wetlands Habitat Guild

Small yellow lady's-slipper (*Cypripedium parviflorum* - one occurrence in the Sioux geographic area. and three historic occurrences in the Absaroka Beartooth Geographic Area), English sundew (*Drosera anglica* - one occurrence in the Absaroka Beartooth Geographic Area), beaked spikerush (*Eleocharis rostellata* - two occurrences in the Absaroka Beartooth Geographic Area), hiker's gentian (*Gentianopsis simplex* - 12 occurrences in the Absaroka Beartooth and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas), meesia moss (*Meesia triquetra* - one occurrence in the Absaroka Beartooth Geographic Area), and northwestern thelypody (*Thelypodium paniculatum* - one occurrence in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area) are at risk plants found within this habitat guild.

Riparian systems occur along creeks and rivers and occupy floodplains, and stream banks. This system is dependent on a hydrologic regime that has annual to episodic flooding. It is often comprised of a mosaic of communities dominated by trees but also includes a diverse shrub and herbaceous component. Cottonwoods and other dominant trees such as Engelmann spruce indicate riparian, and on drier sites, Douglas- fir, and Rocky mountain juniper may be present. Dominant shrubs may include several species of willow, mountain alder, river birch, dogwood, hawthorn, and on drier sites or the dry fringe, chokecherry, rose, silver buffaloberry, Rocky Mountain maple, and snowberry. Proportionately montane riparian, wetlands and fens make up 3 percent or less of the Custer Gallatin in each landscape area and prairie riparian types are present on less than 1 percent.

General threats to riparian or wetland habitats include invasive species, drought, alteration of the original hydrology or hydric soils (that is, diversion, draining, development, road construction, and improper grazing), and warming trends. Management activities that have the potential to disturb soils and vegetation within riparian areas or adjacent to wetlands include road construction, reconstruction, and maintenance; livestock use; disturbances/exclusions that change vegetation conditions in riparian areas and vegetation adjacent to wetlands, invasive plant treatments, recreation use, trails, visitor trampling and camping in riparian areas. Threats to aquatic plant species can come from changes in hydrology and from aquatic plant invaders that can form dense carpets that block light, warmth and oxygen from the water. Established riparian and wetland protection measures are typically in place during Forest Service activity management such as use of best management practices and use of streamside management zones or riparian management zones.

Small yellow lady's-slipper (*Cypripedium parviflorum*) – montane and pine savanna: There is local conservation concern due to low population numbers in restricted habitat adjacent to a campground on the Custer Gallatin. Because this species often occupies small areas, one small, spatially isolated disturbance event could possibly destroy all reproducing plants.

English sundew (*Drosera anglica*) – montane: The Custer Gallatin occurrences are somewhat disjunct from others in northwest Montana. There is local conservation concern due to low population numbers in restricted fen habitat on the Custer Gallatin. Because this species often occupies small areas, one small, spatially isolated disturbance event could possibly destroy all reproducing plants. Local conservation concern due to low population numbers in restricted habitat on the national forest.

Beaked spikerush (*Eleocharis rostellata*) – montane: There is local conservation concern due to low population numbers in restricted habitat on the Custer Gallatin. Because this species often occupies small areas, one small, spatially isolated disturbance event could possibly destroy all reproducing plants.

Hiker's gentian (*Gentianopsis simplex*) – montane: There is local conservation concern due to low population numbers in restricted fen habitat on the Custer Gallatin. Because this species often occupies small areas, one small, spatially isolated disturbance event could possibly destroy all reproducing plants.

Meesia moss (*Meesia triquetra*) – montane: There is local conservation concern due to low population numbers in restricted fen habitat on the Custer Gallatin. Because this species often occupies small areas, one small, spatially isolated disturbance event could possibly destroy all reproducing plants.

Northwestern thelypody (*Thelypodium paniculatum*) – montane: This species' occurrence in forest is near trailhead activity making it potentially vulnerable to associated impacts.

3.5.3 Environmental Consequences

Effects Common to All Alternatives

Sensitive or at-risk plant species occupying habitats that are often disturbed, such as roadsides, suitable timberlands, and high recreation use areas, would be vulnerable to removal of suitable habitat as well as direct removal of individuals, although some sensitive or at-risk plant species can respond favorably to these disturbances. Various surface-disturbing activities, including mineral exploration and development and the associated roads, right-of-ways, and corridors, can directly affect habitats for sensitive or at-risk plant species. Recreational use, collection of plants, fire, as well as improper livestock or wild horse grazing could remove or trample vegetation and disturb soil, resulting in adverse impacts to sensitive or at-risk plant species.

Surface-disturbing activities also can indirectly affect sensitive or at-risk plant species by contributing to soil erosion and transporting invasive species into these habitats. The spread of invasive species could adversely affect sensitive or at-risk plants due to the limited occurrence size and distribution of these rare plants. Surface disturbance also can result in habitat fragmentation, which can isolate populations of sensitive or at-risk plant species. Populations of sensitive or at-risk plant species typically have a patchy distribution across the landscape, and eliminating one or more populations can prevent gene flow among populations if residual populations are too far apart for sufficient cross-pollination. Habitat fragmentation would be a long-term impact to sensitive or at-risk plant species. Utilizing plan components and mitigating projects impacts to minimize surface disturbing and disruptive activities minimizes adverse impacts from surface disturbance across all alternatives.

Habitats that are less subjected to land management activities, such as inaccessible areas, rugged terrain, rocky habitats, and riparian and wetlands, are more likely to be intact. There are fewer threats to species in these habitats and the anticipated adverse impacts from surface-disturbing activities are minimal. The main threats to these areas include invasive species and climate change. In the past, roads were built along streams and through wetlands. There are protections for riparian and wetlands in all alternatives, yet some roads are still on the landscape in those areas and may still be affecting those habitats.

Species adapted to restricted habitats or specific microclimates would have lower survival rates than the more common native species with wider amplitude of habitats as these habitats are altered. Threats to these habitats include direct disturbance (from logging equipment, road building, road maintenance, grazing, and fire suppression activities), habitat alteration (such as canopy removal, edge effects from roads, herbicide, and fire exclusion), invasive species, and climate change.

Climate controls many ecosystem processes including regeneration, vegetation productivity and growth, and disturbance all of which could affect at-risk species on the Custer Gallatin National Forest. While there is some uncertainty regarding the scale, rate, and direction of future climatic conditions in Montana and South Dakota, the majority of published science suggests that warming trends may strongly influence the frequency, intensity, and size of disturbances (such as fire and extensive insect outbreaks) in coming decades on areas of the Custer Gallatin National Forest. Changes in disturbance prompted by climate change are likely as important as incremental changes in temperature and precipitation for affecting ecosystem productivity and species composition. Recent research indicates that these risks may be particularly acute for forests of the northern Rocky Mountains. Conservative future climate scenario models predict that the effects of warming trends result in a lengthened growing season, decreased number of days with snow on the ground, earlier peak snow occurrence, and increased water stress for all sites in the study, which represent temperature and precipitation spectrum in the forests of the Rocky Mountain Region (Boisvenue and Running 2010). Mountain ecosystems are can shift upslope, reducing habitat for many subalpine and alpine tundra species. Mountain tree line is predicted to rise by roughly 350 feet for every degree Fahrenheit of warming (Environmental Potection Agency 1997).

All habitat guilds for Regional Forester sensitive or at-risk species are expected to be impacted by warming trends. Riparian and wetland and grassland and shrubland habitat guilds may increase the rate of desiccation due to increased and prolonged summer temperatures and drought conditions; although the opposite could be true and all guilds could see an increase in precipitation which could result in longer fire seasons and more fire on the landscape. Habitat in the alpine habitat guild for sensitive or at-risk plant species may decrease as a result of climate change and an upward shift of lower alpine habitats over time. Increased fire severity or frequency may also affect all habitat guilds except the riparian and wetland, especially those found outside of the sparsely vegetated habitat guild, either favorably or detrimentally depending upon the species' requirements.

Increases in the severity of disturbances, combined with projected warming trends, may limit habitat for at-risk species over time. Rare and uncommon species, disjunct populations, and species at the edge of their known range are expected to experience a number of barriers when adjusting to warming trends because of the combination of a small number of occurrences, narrow elevation ranges, and requirements of specific soils types. Some sensitive or at-risk species with potential habitat are known to occur on restricted or limited areas within the Custer Gallatin National Forest. Plants confined to outcrops of special soils (for example, Shoshonea) are generally expected to have a far lower chance of successful migration to new suitable sites and thus far greater risks of decline in the face of climate change, than plants that are soil generalists (Harrison et al. 2009). Because of the uncertainty in scale, direction, and rate of climate change, management of sensitive or at-risk plant species on the Custer Gallatin National Forest focuses on maintaining persistent populations throughout the species known range on the national forest.

In the face of warming trends, conservation of plant diversity will likely involve a number of approaches. The geographic ranges and habitat affiliations of sensitive or at-risk plant species will be important considerations in developing conservation strategies. Monitoring of priority species and habitats, coupled with adaptive management, will form the basis for management responses. Ongoing and potential approaches include: control of invasive species to promote vegetation resilience, especially in high-priority habitats; implementation of mitigation measures for land management projects occurring in sensitive or at-risk species occurrences; ecological restoration (that is, for whitebark pine); conservation of at-risk plant species habitats; off-site seed conservation (especially for globally rare species with narrow geographic ranges or habitat affinities); and continued establishment of less developed areas such as research natural areas and botanical special areas (Shelly 2012).

Current Plans

Management Direction under the Current Plans

The 1986 Custer and Gallatin Forest Plans provide management guidance to natural resource managers within the framework of congressional intent (36 CFR 217). The Custer Forest Plan provides general management direction (page 3) that indicates "the goal for the management of threatened and endangered plant and animal species is to provide habitat that contributes to the recovery of the species." Within the framework of the 1986 Custer forest plan, direction is given to manage for retention of habitat of unique plant species, which include sensitive species (Custer Forest Plan, p. 20 and Appendix VII). The Gallatin Forest Plan (as amended 2015) includes a forest-wide standard that "habitat for regionally designated sensitive species on the Gallatin National Forest will be maintained in a suitable condition to support these species" (p. II-19). The current forest plans do not contain specific standards or guidelines related to maintaining whitebark pine.

The 1986 Custer Forest Plan (page 17) indicates that no federally listed threatened or endangered plant species occur on the national forest at that time. Since that time, there continues to be no plants designated as threatened or endangered plant species that occur within the Custer Gallatin National Forest. The combination of Forest Service manual policy for Regional Forester's sensitive plant species and the existing two plans provide protections that would ensure that sensitive species persist on the national forest. These plans have less of a focus on native vegetation improvements than the new plan components.

Effects of the Current Plans

The current plans consider the Regional Forester's sensitive plant species. Population viability is expected to remain stable for all Regional Forester's sensitive species on the Custer Gallatin with plan components from both forest plans. Habitat quality has the potential to improve; however, there are fewer plan components promoting habitat restoration compared to the revised plan alternatives. The current plans' components and policies are expected to maintain habitat quality for sensitive plant species in all habitat guilds. Threats would remain similar to current threats for sensitive plants.

Sensitive species' habitat is vulnerable to threats from ground disturbance and weed spread. Available motorized routes were used as an indicator for alternative comparison as they are often cited as a major weed spread vector. The miles of available motorized routes do not change under the current plans.

Areas considered to have low risks for ground disturbance impacts that could impact sensitive plant species (designated wilderness areas, wilderness study area, recommended wilderness areas, inventoried roadless areas, backcountry areas (low development areas), designated wild and scenic river, and research natural areas) were used as another indicator for alternative comparison. This footprint of reduced threats from ground disturbance and weed spread vectors is comprised of approximately 2,021,800 acres or about 67 percent of the Custer Gallatin under the current plans. Ninety-three percent of Whitebark pine occurs within this footprint. Of the overall 145 Regional Forester's sensitive plant occurrences, 73 occurrences containing 12 sensitive plant species occur in the above reduced threats footprint. They include musk-root (*Adoxa maschatellina*), Barr's milkvetch (*Astragalus barrii*), large-leaved balsamroot (*Balsamorhiza macrophylla*), small yellow lady slipper (*Cypripedium parviflorum* - historic record), English sundew (*Drosera anglica*), beaked spikerush (*Eliocharis rostellata*), hiker's gentian (*Gentianopsis simplex*), meesia moss (*Meesia triquetra*), mealy primrose (*Primula incana* - historic record), Beartooth large-leaved goldenweed (*Pyrrocoma carthamoides var. subsquarrosa*), Barratt's willow (*Salix barrattiana*), and shoshonea (*Shoshonea pulvinata*). The remaining 72 sensitive plant occurrences are outside of the above reduced threats footprint.

Regional Forester's sensitive plant species that will not carry forward as a species of conservation concern include smallflower columbine (*Aquilegia brevistyla),* upward-lobed moonwort *(Botrychium ascendens),* large-leaved balsamroot *(Balsamorhiza macrophylla),* Barr's milkvetch *(Astragalus barrii),* mealy primrose *(Primula incana),* mountain bluebells *(Mertensia ciliata),* and prairie gentian *(Gentian affinis*). Of these, there are three occurrences of Barr's milkvetch and 16 occurrences of large-leaved balsamroot that fall within the above reduced threats footprint.

Due to reduced ground disturbance and weed spread vector potential, the reduced threats footprint area include quality habitat in all habitat guilds. More quality habitat for these species is present under the recommended wilderness areas and backcountry areas under the revised plan alternatives, in that order. Habitat quality and threats remain consistent with current plans; there are fewer additional protection opportunities (for example, permissible restoration activity, and limited access to motorized vehicles) for at-risk plant occurrences.

Species and associated habitat that do not occur in lands suitable for timber production may still occur within forest projects, including vegetation projects, and subject to potential direct and indirect effects. The sensitive plant species would be protected by current Forest Service manual policy and plan components during vegetation project work. Plant species of conservation concern not included on the current Regional Forester's sensitive species (2011) list would not be protected under this alternative.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

Plan components that are relevant to at-risk plants are the same for each revised plan alternative. A complete list of all plan components relevant to at-risk plants may be found in appendix C.

Plan components for all revised plan alternatives state that habitat conditions and ecological processes support the recovery and persistence of at-risk plant species; and that vegetation resilience (such as vegetation composition, structure, and pattern) maintain or restore conditions for the long term persistence of at-risk plant species.

Goals include collaborating with Federal and State agencies, Tribes, and other partners regarding applicable conservation plans in seeking progress towards conservation of at-risk plant species; working with other agencies and landowners to expand inventories, identify potential habitat for at-risk species, and promote protection and restoration of associated habitats; and cooperating with the Greater Yellowstone Coordinating Committee-Whitebark Pine Subcommittee on whitebark pine conservation strategies and adaptive management of habitat.

Plan components include:

- direction that mechanical vegetation management activities that have potential to adversely affect the long-term persistence of at-risk plant populations will be avoided or mitigated;
- decisions authorizing the use of chemicals are to outline protection measures for treatment and measures to minimize injury to at-risk species;
- invasive plant treatments in or near at-risk-plant populations are to use methods that are not detrimental to the long-term persistence of the species;
- underground mine closures are to be designed to address needs of at-risk species;
- new or re-routed trails in wilderness are to be located to cause no impacts to at-risk species;
- new or revised allotment management plans are to design grazing practices (such as stocking levels, duration, timing), or physical structures (such as off-site water developments or hardened stream crossings) to avoid, minimize, or mitigate adverse livestock related effects in order to maintain or improve resiliency of riparian and upland ecosystems, and associated flora and fauna;
- and staging areas for material stockpiles and equipment within Beartooth Highway 212 250-foot centerline easement for maintenance are only to be allowed with mitigation for at-risk plant species
- project -specific analysis determines that management activities may potentially impact known at-risk plant populations, mitigation or protection measures are to be provided to maintain the populations or sustain habitats of at-risk plant;

- wildland fire control lines, slash piles and retardant are not be placed within known populations of at-risk plant species with the exception of where they may be allowed for purposes of restoration or being advantageous to the at-risk plant species, or when needed to protect human life or private property;
- when conducting management activities in or near whitebark pine trees or stands identified for collection of scion, pollen, or seed;
- areas identified as important for cone production; and whitebark pine plantations, project-level design criteria, or wildland fire management strategies are to protect them from potential loss to support the recovery or long-term persistence of this species;
- when treating invasive species or conifer encroachment, design criteria are to address any critical habitat needs of at-risk species;
- salt and supplement placement in grazing allotments are not to be within 0.25 mile of at-risk plant species that are susceptible to livestock impacts;
- and new allotment infrastructure is to be located to minimize livestock impacts on at-risk plant species.

Management approaches (appendix A of the draft revised plan), describe possible strategies for achieving desired conditions and objectives for at-risk plants. These strategies include:

- evaluating areas proposed for vegetation management activities for the presence of occupied or suitable habitat for at-risk species, focusing botanical surveys on increasing known information about other plant species (such as Montana and South Dakota state species of concern and newly discovered species), and monitoring known occurrences of at-risk species;
- if at-risk plants occur in or near infestations, a weed control plan consistent with protection measures outlined in current weed environmental impact statement decisions is to be developed to help protect the at-risk plant population;
- training is to be provided to weed crews to identify sensitive plants so that new sites can be identified and protected; weed crews or contractors are to be provided with maps of all known at-risk plant populations so that known sites can be identified and protected;
- when considering chemically treating invasive plants within at-risk plant populations, specific chemicals that monocot at-risk plant species tolerate are described;
- and the highest priority for allocation of funding for wells and pipelines are for those that provide offsite water developments to reduce impacts to at-risk plant populations and other identified resources that are susceptible to grazing impacts

Effects Common to the Revised Plan Alternatives

At-risk plant species’ habitat is vulnerable to threats from ground disturbance and competition from weed infestations. Available motorized routes were used as an indicator for alternative comparison as they are often cited as a major weed spread vector (Taylor et al. 2012). Table 27 displays miles of available motorized routes by alternative.

Table 27. Miles of motorized roads and available motorized trails by alternative

Attribute	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Miles of open roads and motorized administrative routes	2,265	2,265	2,265	2,265	2,265
Miles of trail available to motorized recreation	1,128	1,128	1124	946	1,128

Alternative A represents future projections if the current plans are kept

Alternative D would be the most favorable to limit the spread of invasive species from motorized use because it has the least amount of trails available to motorized. The current plans and alternative E would be similar for having a higher potential to increase the spread of invasive weed species through motorized transportation since the alternatives have the most miles of trails available to motorized use. Alternatives B and C would be have similar effects to potential weed spread and competition with at-risk species, with alternative C being more favorable as there are fewer of trails available to motorized use than alternative B.

Although alternative D would be the most favorable for slowing the spread of invasive species by motorized means, the alternative could also create issues for existing weed infestations to go undetected and untreated in new recommended wilderness areas and backcountry areas. Alternative D would change the most miles of trails available to motorized use and possible weed vectors of any alternative, but could also increase treatment difficulty or detection of existing weed populations in new recommended wilderness and backcountry areas.

Areas considered to have low risk for ground disturbance impacts that could impact at-risk plants (designated wilderness areas, wilderness study area, recommended wilderness areas, inventoried roadless areas, backcountry areas (low development areas), designated wild and scenic river and research natural areas) were used as another indicator for alternative comparison.

Table 28 displays the relationship of at-risk plant species with areas considered to have low risk for ground disturbance by alternative.

Table 28. At-risk plant species' relationship to areas considered to have low risk for ground disturbance by revised plan alternative

Attribute	Alt. B	Alt. C	Alt. D	Alt. E
Acres considered to have low risk for ground disturbance (designated wilderness areas, wilderness study area, recommended wilderness areas, inventoried roadless areas, backcountry areas, designated wild and scenic river and research natural areas)	2,046,700	2,072,900	2,115,200	2,023,200
Percent of national forest	67%	68%	70%	67%
Number of at-risk plant species within low risk areas	9	9	9	9
Number of at-risk plant species within low risk areas	16	16	16	16
Number of at-risk plant occurrences within low risk areas	26	26	34	26
Number of at-risk plant occurrences outside of low risk areas	119	119	111	119
Percent of whitebark pine within low risk areas.	93%	93%	94%	93%

Some musk-root, meesia moss, shoshonea, dense-leaf draba, English sundew, hiker's gentian, annual Indian paintbrush, Nuttall's desert-parsley, and beaked spikerush occurrences are within areas considered as low risk for ground disturbance under alternatives B, C, and E. Some musk-root, meesia moss, shoshonea, dense-leaf draba, English sundew, hiker's gentian, annual Indian paintbrush, Nuttall's desert-parsley, and spiny hopsage occurrences are within areas considered as low risk for ground disturbance under alternative D.

Due to reduced ground disturbance and weed spread vector potential, these areas considered to have low risk of ground disturbance generally support quality habitat in all habitat guilds. More quality habitat for these species are present under Alternatives C and D and less quality habitat under alternatives B and E due to differences in the amount of recommended wilderness areas and backcountry areas by alternative.

As a result of the revised plan alternative components, at-risk plant populations in all habitat guilds are expected to be maintained and provide at-risk plant species persistence with opportunities to restore sites if conditions warrant. Regional Forester's sensitive plant species that are not currently on the species of conservation concern list would no longer be specifically protected once the new plan is implemented. However, coarse-filter vegetation related plan components would provide for their habitat needs. Even without species-specific direction for Regional Forester's sensitive plant species, the plan will still provide for the diversity of all native species, including these, as required by the Planning Rule. The Regional Forester's sensitive plant species occur in habitats with either infrequent project activity (for example, alpine habitat guild), in other habitats protected by forest plan components or are not known within the plan area.

Some plan components specifically address needs of the at-risk species, while others provide protection to the site and habitats associated with at-risk species (such as riparian management zones). Plan components that ensure the conservation of at-risk plants include:

- desired conditions that support maintaining the ecological processes and vegetation conditions that contribute to the conservation of these species;
- providing mitigation and protection measures to maintain species and habitats during planning and implementation of activities that may impact them;
- standards and guidelines that provide management direction within riparian management zones that will also provide protection to at-risk plants associated with these habitats;
- standards and guidelines that protect soils from undesirable disturbance during management activities.

The plan components that are likely to have an effect on at-risk plants species habitat guilds are summarized in the following sections. Individual species are not addressed for forestwide plan components.

Cold Forest Habitat Guild

The current forest plans do not contain standards or guidelines related to maintaining whitebark pine. The revised plan components include objectives for treatment of at-risk species, which includes whitebark pine. The current and revised plans have opportunities to restore whitebark pine and are expected to contribute to this species persistence in the plan area despite the current population trend.

Habitat quality would improve for whitebark pine under the revised plan alternatives at a faster rate than the current plan.

Management approaches include targeted restoration treatments that may be desirable in whitebark pine stands where disturbance is determined to benefit the species. For example, removing shade-tolerant conifers may aid in the persistence of mature whitebark pine, increase the potential for nutcracker caching, and to open up areas for planting of rust-resistant trees. All projects would be evaluated to assess their potential impacts to the species, especially in cases where there are healthy cone-producing trees present. Conservation and restoration treatments would typically be designed to create openings in sites that are advantageous for reestablishing whitebark pine. For whitebark physiology, ecology, genetics, distribution, mortality, and regeneration on the Custer Gallatin, the Whitebark Pine Strategy for the Greater Yellowstone Area, Adaptive Action Plan prepared by the Greater Yellowstone Coordinating Committee (2011 and 2015, respectively), and any new best available science for possible whitebark pine restoration strategies and activities would be used.

Alpine Habitat Guild

One at risk species' occurs within riparian and wetland settings in the alpine habitat guild and known occurrences are within Line Creek Plateau Research Natural Area. Plan components for Line Creek Plateau Research Natural Area prohibits hitching, tethering, or picketing horses, or other livestock within 200 feet of a live stream or other free flowing water. Camping (including building a fire, other than fires confined to liquid fuel stoves) would be prohibited within 200 feet of any lakeshore or 100 feet of any live stream or other free flowing water. These plan components are anticipated to support long-term persistence of the at-risk species associated with this habitat guild. Research natural area direction also does not encourage recreational use, and the existing levels of recreation are not anticipated to adversely impact this species (USDA Forest Service 2000). This research natural area is, however, apparently popular for mountain biking, which will continue on system trails under current research natural area management. However, policy directs that special closure orders could be used when needed to protect the research natural area features for which it was designated.

Other plan components, outlined in the riparian and wetland habitat guild section below, would also apply to the particular willow species habitat which are anticipated to support long-term persistence of the at-risk species associated with this habitat guild.

Broadleaf Woodlands Habitat Guild

Plan components minimize stem damage, soil compaction, or root damage from frequent human use, new buildings or other structures associated with developed sites or outfitter and guide camps and from not allowing construction of new permanent or permanently retaining temporary roads in aspen stands or woody draws (except as needed to cross the area or as needed for restoration purposes). These components are anticipated to support long-term persistence of the at-risk species associated with this habitat guild.

Plan components minimize browsing pressure or trampling and rubbing damage to vegetation when new allotment infrastructure is designed not to attract livestock into broadleaf woodlands (for example, new water developments should be located away from hardwoods and new fences should not funnel or congregate livestock into hardwoods). These components are anticipated to support long-term persistence of the at-risk species associated with this habitat guild.

Plan components that do now allow cutting of hardwood trees except for purposes of human safety or selective cuts for regeneration purpose, are anticipated to support long-term persistence of the at-risk species associated with this habitat guild.

Plan component for new or revised allotment management plans (which are to design grazing practices (such as stocking levels, duration, timing), and physical structures (such as off-site water developments or hardened stream crossings) to avoid, minimize, or mitigate adverse livestock related effects in order to maintain or improve resiliency of riparian and upland ecosystems, and associated flora and fauna) are anticipated to support long-term persistence of the at-risk species associated with this habitat guild.

Grasslands or Shrublands Habitat Guild

Plan components that restores or maintains this habitat through invasive species control activities and projects to control conifer encroachment, are anticipated to support long-term persistence of the at-risk species associated with this habitat guild.

Plan component for new or revised allotment management plans (which are to design grazing practices (such as stocking levels, duration, timing), and physical structures (such as off-site water developments or hardened stream crossings) to avoid, minimize, or mitigate adverse livestock related effects in order to maintain or improve resiliency of riparian and upland ecosystems, and associated flora and fauna) are anticipated to support long-term persistence of the at-risk species associated with this habitat guild.

Sparsely Vegetated Habitat Guild

Plan component for new or revised allotment management plans (which are to design grazing practices (such as stocking levels, duration, timing), and physical structures (such as off-site water developments or hardened stream crossings) to avoid, minimize, or mitigate adverse livestock related effects in order to maintain or improve resiliency of riparian and upland ecosystems, and associated flora and fauna) are anticipated to support long-term persistence of the at-risk species associated with this habitat guild.

Riparian and Wetlands Habitat Guild

For at-risk plant species in riparian and wetland habitat guild, plan components that limit activity in riparian management zones are anticipated to benefit these species by reducing direct impacts from trampling, mining, and recreational activities. Meeting or moving toward proper functioning condition across all alternatives improves habitat for sensitive or at-risk plant species. The standard for designation of buffers (riparian management zones) adjacent to streams and wetlands will protect at-risk plants associated with fen and wetland habitat. Width of the buffer for mapped ponds, lakes, reservoirs, and wetlands is a minimum 200 feet for ponds and wetlands greater than one acre.

Plan component for new or revised allotment management plans (which are to design grazing practices (such as stocking levels, duration, timing), and physical structures (such as off-site water developments or hardened stream crossings) to avoid, minimize, or mitigate adverse livestock related effects in order to maintain or improve resiliency of riparian and upland ecosystems, and associated flora and fauna) are anticipated to support long-term persistence of the at-risk species associated with this habitat guild.

The management approaches outlined in appendix A of the draft revised plan include recommended actions to review additional information as it becomes available and gather data during field work for project-level reviews. If new pertinent information becomes available indicating a potential threat to loss of viable populations on the Custer Gallatin, these species would be reconsidered and the species of conservation concern list may be adjusted.

Population persistence for plant species of conservation concern is expected to remain stable because the plan components will maintain and restore habitat for these species. The revised plan alternatives include objectives for restoration activities; however, the current plans and the revised plan alternatives result in similar outcomes for at-risk plants. Habitat quality is expected to improve under these alternatives at a faster rate for all at-risk plant species than the current plans. Threats remain similar between the current plans and the revised plan alternatives for at-risk plants.

Consequences to At-Risk Plant Species from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Timber Management

Timber harvest would occur under all alternatives, though the acres harvested vary. Timber harvest is most likely to occur on lands identified as suitable for timber production and it is projected that 3 to 4 percent of the forested areas would be available for timber management each decade. Harvest increases some threats to at-risk species, but also can create a mosaic pattern on a landscape and promote early successional stands with some treatments, such as regeneration harvest.

Under the current plans, sensitive plant species would receive site-specific protection following botanical reviews and surveys (Forest Service Manual 2670) and negative effects would be minimized. This would continue to occur with the plan components for at-risk species under the revised plan alternatives and the management strategies in appendix A of the draft revised plan. Vegetation treatments can also increase forest resiliency by treating insect and disease and reducing fuel loads, improving forest health in the long term. Site disturbance and increased weeds without mitigation could negatively impact habitat.

All alternatives have varying amounts of land suitable for timber production, but the impact of timber plan components on at-risk species is consistent between the revised plan alternatives. All habitat guilds can be impacted by timber production, even if habitats guilds, such as aquatic, alpine or grassland, are not directly harvested for timber. Mechanical activities include vegetation management treatments, whether for restoration or to meet timber production objectives. Activities, such as logging, can have impacts to plants and plant habitat through canopy removal, soil disturbance and erosion, and stream sedimentation. In addition, mechanical activities for vegetation treatment may require road building. Roads increase access to sensitive habitats and can fragment habitat, thus, providing an avenue for invasive plant species. Reconstruction and maintenance of designated roads can directly or indirectly affect plant populations by introducing competitive weeds and altering availability of light, nutrients, and moisture. Sudden changes in seral stage, or an abundance of early seral stages, also reduce the available habitats for those plants that require mid-to-late seral stages. However, those species that prefer openings, early-seral stages, or some ground disturbance, could benefit from moderate levels of mechanical activities. The restoration of historical fire regimes and conditions within the natural range of variation (with a range of seral stages for different potential vegetation groups) may benefit some at-risk species in the long term.

As a result of these revised plan alternatives’ plan components, at-risk species and their respective habitats would be considered during vegetation projects and grasslands, shrublands, wetland and riparian, sparsely vegetated habitat guilds are expected to be maintained and continue to provide persistence of at-risk plant species despite the potential for impacts in areas used for timber production. The revised plan alternatives are more explicit regarding resource protections, though similar guidelines are applied under the current plans.

Effects from Vegetation Management

All habitat guilds are impacted and supported by the revised plan alternative vegetation desired conditions. Broadly, the desired conditions for terrestrial vegetation on the Custer Gallatin National Forest are characterized by increases in large trees and large forest size classes; more open forest densities; vigorous non-forested plant communities; increasing early-seral shade tolerant species; and maintaining the full suite of native biodiversity on the landscape. More information is available in the terrestrial vegetation section. The desired conditions are consistent with the Forest Service's understanding of the natural range of variation and when met are most likely to be resilient in the future given expected drivers such as climate change, drought, vegetation succession, wildfire, insects and disease, and the demands of people. Desired conditions for vegetation support native species and habitats within their natural range of variation, including at-risk species.

Ground disturbing activities and changes in site conditions that could impact at-risk species are likely to result from the terrestrial vegetation plan components. As discussed above, the restoration of historical fire regimes and restoration of conditions towards historical range of variation with a range of seral stages for different potential vegetation groups may benefit some at-risk species in the long term.

These revised plan alternative vegetation plan components are expected to maintain and continue supporting at-risk plant species on the Custer Gallatin National Forest. Habitat quality would improve for at-risk species in all habitat guilds under the plan components in the revised plan alternatives.

Effects from Fire and Fuels Management

All alternatives use fire as a tool to accomplish management goals and objectives. The objectives for fuel reduction are usually complementary to the other desired vegetation conditions, including those beneficial to at-risk species, and especially as related to forest resiliency. Several factors are important to consider with regard to at-risk plants. The effect of fire on individual at-risk plant species depends on their life history characteristics, the life stage of the plants when the fire occurs, temperature and moisture conditions, and the fuel conditions present when the fire occurs. For example, spring burning may result in negative or positive effects to the survival, flowering and fruiting of plants depending on these factors, and would need to be evaluated in each situation (Brown and Smith 2000). Considering at-risk species during the project planning process should ensure that the timing and placement of prescribed burns is used to maintain at-risk plant populations as much as possible by timing when phenologically appropriate and avoiding populations of species adverse to fire.

Another factor in many areas of the Custer Gallatin is the risk of uncharacteristic high severity wildfire as a result of high fuel loads which has resulted from various causes, such as fire suppression and the recent outbreak of bark beetles. Without some wildland fire and mechanical fuels treatment introduced to mitigate the threat of high severity fire, at-risk species populations are susceptible to being eliminated in areas on the landscape in all forested habitat guilds. Many species tolerate and in fact require frequent low severity fire to maintain populations on the landscape such as Beartooth large-flowered goldenweed.

Another consideration is that some at-risk species require regular fire to maintain early successional conditions. This includes species in the wetland and riparian, and grassland and shrubland habitat guilds, and could potentially incorporate additional habitat in the future depending on species specific requirements, which can change depending on new best available science and adjustments to the plant species of conservation concern list. Riparian management zone plan components allow for wildland fire as long as aquatic and riparian associated resources are maintained or enhanced which would include associated riparian and wetland dependent at-risk plant species.

In general, most plant species would benefit by the restoration of more historical fire regimes. For those at-risk plants that thrive in open areas created by fires, using fire to help restore a more natural fire regime could benefit those species in the long term. There are also impacts to plants associated with wildfire suppression activities, such as fire line construction and other mechanical activities, reforestation following fire, and the increased potential for the spread of noxious weeds.

At-risk plants have various reactions to fire. As a result of the revised plan alternative components, all habitat guilds are generally expected to be maintained and continue supporting at-risk plant species, as well as the species that are currently on the sensitive plant list but that would not be specifically protected as a species of conservation concern once the new plan is implemented. Analysis prior to implementation would mitigate populations and habitat that could be detrimentally impacted from vegetation treatments, and overall habitats benefit from fire occurring on the landscape similar to historic fire regime conditions. Emphasis in the new plan to allow natural fire to function in its ecological role would likely benefit native plant species as a whole, with few exceptions.

As a result of the revised plan alternative components that encourage natural fire regimes on the landscape, habitat for multiple habitat guilds is expected to maintained and re-established. This would contribute in the long term to the persistence of at-risk plant populations on the Custer Gallatin, though increased short-term risk would likely occur. Habitat quality would improve for all at-risk species habitat guilds that require frequent fire to maintain desired seral stage under the plan components in the revised plan alternatives by allowing natural fire to play a larger role on the Custer Gallatin. Threats currently exist from uncharacteristic large, high severity fire and also from fire suppression tactics. The minimum impact strategy for fire suppression in some locations would reduce threats to at-risk plant species in those habitats. Threats from suppression in location where minimum impact strategies are not used and threats from catastrophic fire events would remain.

Effects from Watershed, Soil, Riparian, and Aquatic Management

The threats to associated wetland and riparian at-risk plant species include hydrologic and nutrient alterations. Mechanical vegetation treatments, off-road vehicles, roads and trails, improper livestock grazing, and high severity wildfires are some of the actions that affect the hydrologic regimes or nutrient inputs. Subwatersheds provide the distribution, diversity, and complexity of landscape-scale features including natural disturbance regimes and the riparian and wetland habitat guild to which native species, populations, and communities are uniquely adapted within those ecosystems, such as at-risk plant species. The revised plan alternatives include desired conditions that would specifically support vulnerable plant habitat in the previously mentioned habitat guilds. The revised plan alternative components have additional protection measures and an increased emphasis on the restoration and maintenance of riparian and wetland resources when compared with the existing plans reflected in the current plans.

As a result of revised plan alternative components, wetland and riparian habitat guilds are expected to be maintained and continue supporting all at-risk plant species that occur in these habitats. The revised plan is more explicit on riparian and wetland ecosystems protections, connectivity in riparian habitats, and groundwater-dependent systems. In addition to following state guidelines and best management practices in the previous plans. Revised plan alternative components are expected to contribute to persistent populations for all at-risk species in riparian and wetland habitats by preserving required habitat characteristics for these species. Habitat quality would improve for all at-risk species in the riparian and wetland habitat guilds under the plan components in the revised plan alternatives. Threats would be reduced for at-risk plants in these wetland and riparian habitats in the revised plan alternatives.

Effects from Wildlife Management

Habitat connectivity would be improved under the revised plan alternatives by the prioritization of certain areas on the Custer Gallatin National Forest to maintain uninterrupted habitat corridors. These areas would limit activities and would limit disturbance in certain years. The focus on habitat connectivity would improve effectiveness of the areas to support wildlife and diverse natural ecosystems.

In all alternatives, several of the plan components of the lynx and grizzly bear direction would complement the at-risk plant plan components, by describing a desired condition to manage vegetation to approximate natural succession and disturbance processes, and provide a mosaic of habitat conditions through time. These components would contribute to the maintenance of habitat for at-risk plant species.

Effects of Land Allocations

Management direction for research natural areas, retained for all alternatives, would meet the desired condition for at-risk or sensitive plant species within alpine areas. In research natural areas timber production, timber harvest, motor vehicle use, road construction, and mechanical fuel treatment, development are unsuitable uses, under all revised plan alternatives. In effect, research natural areas serve as reserves for at-risk plant species, as well as for many other natural resources. While it is possible that individuals of at-risk plant species inhabiting alpine environments in research natural areas may be affected by authorized activities, these impacts are expected to be minor, and not result in a loss of population persistence on the Custer Gallatin. New trail construction would have to comply with policy and plan components, directing that new trail construction avoid threatened, endangered, or at-risk plant locations. At-risk plant species found within research natural areas on the Custer Gallatin include Barratt’s Willow (Line Creek Plateau Research Natural Area) and *Shoshone pulvinata* (Lost Water Canyon Research Natural Area).

All revised plan alternatives would have the same level of ability to achieve desired vegetation conditions within recommended wilderness areas and backcountry areas through the use of vegetation treatments. All have forest plan direction that allow restoration activities to occur as long as the ecological and social characteristics that provide the basis for wilderness recommendation are maintained and protected. Anticipated vegetation treatment activities would largely be associated with the restoration of high elevation ecosystems, and whitebark pine forest communities in particular. There may be other treatments occurring to achieve restoration objectives outlined in the plan components. The most likely treatment would be prescribed burning (planned ignition), in some cases followed by limited planting of conifer seedlings. Objectives would include restoration of desired forest structure and compositions, and to restore desired landscape patterns.

Effects from Access and Recreation Management

Recreation impacts can include trampling, by hikers, pack animals, and off-road vehicle use. Road building and the development of campgrounds and other facilities used by recreationists can impact plants, as these developments make more areas accessible and concentrate use. Dispersed camping and recreation have similar impacts, which are more difficult to monitor. Parking areas, particularly undesignated areas, pose similar impacts to plants. In addition, there can be long-term impacts of bisecting a rare plant population with a road or similar feature and affecting the reproduction or plant dispersal. Other recreational impacts include off-road vehicle use, which can also disturb soil, affecting both habitat and potential habitat. Roads and trails for recreational use can contribute to the spread of noxious weeds and increase the accessibility of areas to livestock as well as native ungulates, which in turn can increase the impacts of trampling, herbivory, and congregation.

The lack of access in many areas can remove opportunities for cost-efficient restoration such as weed control and lead to habitat degradation overtime. Infrastructure can also provide weed spread vectors and cause unintentional erosion, which can negatively impact at-risk species.

Riparian and wetland guilds are protected from recreational related damages by riparian management zone plan components, reducing risk for species that occur in with these habitats. Designated wilderness plan components in all alternatives that limit group size and close certain areas to camping and stock use may help reduce competition from potential for invasive weed infestation. Plan components direct that recreation facilities, including trails and dispersed sites, have minimal impact on at-risk species.

Effects from Minerals Management

Development of energy and mineral resources has the potential to adversely impact at-risk species through all phases of development. Impacts include mortality to individual at-risk plants, or entire populations, as well as habitat loss and fragmentation. Under plan components, at-risk species habitat quality would remain similar between the action and the current plans. Threats would be reduced for at-risk plants by the revised plan alternatives plan components. Site specific surveys and/or assessments at the project level stage would further reduce these threats.

Effects from Permitted Livestock Grazing

There are nearly 666,230 acres of primary rangelands with permitted livestock in all alternatives. Eight at-risk plant species (oval-leaf milkweed, narrow-leaved milkweed, Nuttall’s desert parsley, Visher’s buckwheat, Beartooth large-flowered goldenweed, heavy sedge, Oregon checker-mallow, and Frenchman’s bluff moonwort) and associated 87 at-risk plant occurrences could have threats from potential grazing related activity. All habitat guilds except alpine have the potential to be impacted by livestock or wild horse grazing, which when grazed improperly can cause hydrologic conditions to change, trampling to individual species, and habitat degradation through invasive species introduction. Improper livestock grazing can greatly impact riparian habitats and at-risk plant habitat. The at-risk plant species would be protected by revised plan alternatives plan components during project level allotment planning to prevent negative impacts associated with livestock.

Revised plan alternatives plan component for new or revised allotment management plans which are to design grazing practices (such as stocking levels, duration, timing), and physical structures (such as off-site water developments or hardened stream crossings) to avoid, minimize, or mitigate adverse livestock related effects in order to maintain or improve resiliency of riparian and upland ecosystems, and associated flora and fauna are anticipated to support long-term persistence of the at-risk species. As a result of these plan components, grasslands, shrublands, wetland and riparian, and sparsely vegetated habitat guilds are expected to be maintained and to continue supporting the persistence at-risk plant species in livestock allotments. There would be opportunities in the future to restore habitats that have become degraded over time. The language in the revised plan alternatives is more explicit than the current plans, but management direction to preserve habitat quality is generally similar. Habitat quality would improve with the revised plan alternatives for at-risk species in all habitat guilds under the livestock grazing plan components due to increased monitoring and active management.

Effects from Invasive Species Management

Invasive species can have a major impact on at-risk species on the Custer Gallatin National Forest. In general, increased ground disturbance corresponds with increased weed spread. Roads, trails, livestock, and canopy reduction can provide ideal pathways for the introduction of exotic and non-native species. Introduced, invasive plant species can displace at-risk species through competitive displacement. Competition from invasive nonnative species and noxious weeds can result in the loss of habitat, loss of native pollinators, and decreased at-risk plant species persistence. Additional subsequent impacts include herbicide spraying and mechanical ground disturbance to control noxious weeds once they gain a foothold.

Regarding the risk of weed invasions and expansion of infestations into at-risk habitat guilds, the alternatives would vary in some ways with reduced emphasis on weed treatment in alternative E due to differences in objectives for treatment. As such, under the current plans and alternatives B through D, all habitat guilds would be expected to benefit from the reduction of invasive species, particularly the wetland and riparian, and grassland and shrubland guilds and would contribute to stable at-risk plant populations on the Custer Gallatin. There would be less emphasis on weed control under alternative E due to reduced treatment objectives.

The revised plan alternatives provide similar protections and guidelines for invasive species treatment as the existing plans; however, additional plan components specify treatment of weeds in and near at-risk plant occurrences. This is expected to increase the opportunities for at-risk plant restoration on the Custer Gallatin. Threats would remain similar to the current plans. Habitat quality would improve for at-risk species occurrences under the revised plan alternatives.

Effects from Soil Management

All habitat guilds depend on soil quality and productivity within their respective habitats. Forest Service activities that lead to soil compaction or soil contamination with toxic materials have the potential to negatively impact sensitive plant habitat. Some activities that can threaten soil quality include mechanized vegetation treatments, roads, and off-road vehicles. As a result of the revised plan alternatives soils plan components threats to soil productivity from mechanized vegetation treatments and roads in particular are minimized and all habitat guilds are expected to be maintain soil quality and productivity, which would contribute to the persistence of at-risk plant populations on the Custer Gallatin. The revised plan alternatives soils plan components provide protections and guidelines for soil productivity, which would support sensitive plant habitats and populations that are not found in the current plans. The vegetation plan components include a desired condition that supports biological soil crusts that is not in the current plans. This desired condition is expected to provide additional protection for bryophytes, lichens, and other flora that could exist on the national forest. Habitat quality would improve for all habitat guilds in the revised plan alternatives. Threats would remain similar to the current plans.

Cumulative Effects

Increasing Human Populations

Additional stressors that may increase in the future are increasing population levels, both locally and nationally, with resulting increasing demands and pressures on public lands. At present, local populations are increasing in the counties to the west and north of the Custer Gallatin National Forest, but are declining or stable in other areas. As related to forest and vegetation conditions, these changes may lead to increased demands for commercial and non-commercial forest products, elevated importance of public lands in providing for habitat needs of wildlife species, and changing societal desires related to the mix of uses public lands should provide. The revised plan alternative components would be adequate to support persistent at-risk plant populations and habitat on the Custer Gallatin as human populations and demands increase. Activities known to be threats to at-risk plant habitat guilds as described in the effects common to all alternatives section above that occur or originate on other ownership land can impact populations and habitat on the national forest.

Adjacent Lands and Other Management Plans

The cumulative effects are the same as outlined in the invasive species section relative to consistency with other adjacent forest plans, Bureau of Land Management resource management plans, and the Foundation Document for Yellowstone National Park.

The Natural Resources Conservation Service Soil Health strategy (2015) briefly outlines goals related to promoting soil health and conservation, primarily on agricultural lands. Soil quality is expected to good, but these areas not likely to support at-risk plant populations on agricultural lands. These areas are considered to put at-risk plants in the grasslands habitat guild at greater risk for impacts with little to no suitable habitat available compared to historic conditions.

The South Dakota and Montana Natural Heritage Program is a member of NatureServe, an international network of biological inventories known as natural heritage programs or conservation data centers that operate in all fifty U.S. states, Canada, Latin America, and the Caribbean. Lists of rare, unique or vulnerable plants, animals and biological communities are maintained by each heritage program. They provide important tools from the South Dakota and Montana Natural Heritage Databases (a system that allows locations and related information on rare species to be entered and shared for environmental review and conservation purposes) which are complimentary with conservation considerations for Custer Gallatin National Forest at-risk plants and quality habitat.

Montana’s 2015 State Wildlife Action Plan identifies community types, focal areas, and species in Montana with significant issues that warrant conservation attention. Every community type in Montana was considered in this plan. Conservation actions were developed for the community types and species considered to be in greatest conservation need, resulting in a document that provides priority conservation direction in Montana which is complementary with conservation considerations for Custer Gallatin National Forest at-risk plants and quality habitat.

South Dakota's 2015 Wildlife Action Plan uses an ecosystem approach to assess the health of South Dakota's fish and wildlife and associated habitats (SDGFP 2015; Amended 2018). Plant species are not listed as species of greatest conservation need (SGCN) in the Plan. However, the plan refers to the terrestrial and riparian and wetland ecosystems' planning approach, which encourages voluntary actions among conservation partners, agencies (such as the U.S. Forest Service), Tribes, and individuals to provide habitats that occurred prior to European settlement of South Dakota, with the concept of using an historical reference is based on the fact that the array and distribution of ecosystems across South Dakota shaped and sustained the region's biological diversity and that most species in South Dakota today resulted from historical ecosystems and associated disturbance regimes in the Great Northern Plains. This plan is complementary to having resilient ecosystems in which at-risk plants can persist.

Montana Department of Natural Resource Conservation (Statewide Forest Resource Strategy, 2010) conducted a statewide assessment of forest resources on all land ownerships in Montana and identified issue-based focus areas with implementation strategies and deliverables for each including focus area 1: Forest Biodiversity and Resiliency. Strategies include managing ecosystem and biotic composition to achieve ecological integrity through recovery of species diversity, water quality and quantity, soil quality and function by implementing best available science and adaptive management; and increasing terrestrial carbon sequestration and soil carbon sinks. The maintenance of native vegetation and emphasis on diversity is expected to benefit at-risk plant species that often occur in rare or sensitive habitats. This management is expected to be complementary, though some impacts to populations could occur.

Some county wildfire protection plans map and define the wildland urban interface. The Custer Gallatin National Forest notes that these areas may be a focus for hazardous fuels reduction, and other plan components (such as Northern Rockies Lynx Management Direction) have guidance specific to these areas. Managing for open forests and fire adapted species may be particularly emphasized in these areas. Overall, the effect of the county plans would be to influence where treatments occur to contribute to desired vegetation conditions. Species in the grasslands guild in these areas would likely benefit from open forest habitat.

Plants of special concern are protected from new development as provided for in Madison County growth plans. At-risk plant on private lands are considered to be at greater risk of local extirpation due to lack of protections. The county plans generally aim to maintain native vegetation communities and reduce noxious weeds. The preservation of native habitats would maintain habitat for at-risk species where they occur.

Conclusion

Occurrences of all Regional Forester sensitive and at-risk plant species are expected to persist on the Custer Gallatin National Forest under all alternatives due to the Forest Service manual direction for sensitive species in the current plans and the revised plan alternatives' plan components for at-risk species. Habitat quality and threats vary between each alternative due to different land allocations such as differences in acreage of the more undeveloped and protected areas, and proposed as land suitable for timber production.

The current plans would maintain the existing separate plans for the Custer and Gallatin National Forest. While all plants are expected to remain stable on the Custer Gallatin as a result of this alternative due to Forest Service manual policy and plan components for sensitive species, there are fewer plan components in the current plans that specifically protect some species' habitats.

Alternatives B through E have considerable changes to forest-wide plan direction that apply to each at-risk species' habitat on the Custer Gallatin. The revised plan components provide additional protections to at-risk plant habitats. All plan components relevant to at-risk plant species remain the same between the revised plan alternatives. Areas considered to have low risk for ground disturbing threats include designated wilderness areas, wilderness study area, recommended wilderness areas, inventoried roadless areas, backcountry areas, designated wild and scenic river, and research natural areas. Collectively, alternative D provides the most acreage with the most quality habitat, followed by alternatives C, B, and E. Some limitation of mechanical treatment could occur as a result of increased recommended wilderness, though restoration treatments would generally be permissible. This is mainly expected to impact whitebark pine, but future species of conservation concern could also be impacted, especially if more stringent restrictions were to be placed on mechanical treatments if these areas were designated as official wilderness by Congress.

Although the projected acres of timber harvest varies by alternative, there would be little difference in the effect of timber harvest due to plan components designed to minimize impacts to at-risk species.

Motorized access has limited indirect and cumulative impacts to at-risk plants species on the Custer Gallatin. Motorized routes are primary weed spread vectors that are threats to at-risk species. The current plans and alternatives B and E would not change the current use of any roads or trails. Under alternative C, about four miles of trail would no longer be available to motorized recreation use. Under alternative D, about 172 miles of trail would no longer be available to motorized recreation use. Reduced motorized travel use would correspond to reduce threats from weed spread and competition with at-risk species.

A comparison of at-risk species indicators for each alternative is presented in table 29.

Table 29. Sensitive and at-risk species indicators and effects determinations by alternative

Species Category	Alternative A (No Action)	Alternative B and C	Alternative D	Alternative E
Sensitive Species (31 known species & 125 occurrences)	**Potential Habitat Quality**: no change from current condition. About 67% of the national forest is considered low risk for ground-disturbing threats. **Threats**: Three sensitive species and 10% known occurrences have reduced threats in areas considered to be low risk for ground disturbance. Potential weed spread from vectors associated with motorized routes in the current plans will remain the same as under alternatives B and E. Plan components and policy would decrease threats and mitigate associated ground disturbing activities. **Effects Determination**: May impact individuals but would not contribute toward a trend for Federal listing or loss of viability.	**Potential Habitat Quality**: Plan components increase habitat quality. About 67% (Alt. B) and 68% (Alt. C) of the national forest is considered low risk for ground-disturbing threats. **Threats:** 7 sensitive species and 10% known occurrences in alt. B & 8 spp. & 10% known occurrences in alt. C have reduced threats in areas considered to be low risk for ground disturbance. Potential weed spread from vectors associated with motorized routes in alternative B will remain the same as under alternatives A and E. Potential weed spread from vectors associated with motorized routes in alternative C will have reduced threats from invasive weed competition since motorized routes are reduced by 4 miles when compared to alternatives A, B, and E. Plan components and policy decrease threats and would mitigate associated ground disturbing activities. **Effects Determination**: May impact individuals but would not contribute toward a trend for Federal listing or loss of viability.	**Potential Habitat Quality**: Plan components increase habitat quality. About 70% of the national forest is considered low risk for ground-disturbing threats. **Threats:** 11 sensitive species and 18% known occurrences have reduced threats in areas considered to be low risk for ground disturbance. Potential weed spread from vectors associated with motorized routes in alternative C will have reduced threats from invasive weed competition since motorized routes are reduced by 172 miles when compared to alternatives A, B, and E. Plan components and policy decrease threats and would mitigate associated ground disturbing activities. **Effects Determination**: May impact individuals but would not contribute toward a trend for Federal listing or loss of viability.	**Potential Habitat Quality**: Plan components increase habitat quality. About 67% of the national forest is considered low risk for ground-disturbing threats. **Threats:** 7 sensitive species and 6% known occurrences have reduced threats in areas considered to be low risk for ground disturbance. Potential weed spread from vectors associated with motorized routes in alternative E will remain the same as under alternatives A and B. Plan components and policy decrease threats and would mitigate associated ground disturbing activities. **Effects Determination**: May impact individuals but would not contribute toward a trend for Federal listing or loss of viability.

Species Category	Alternative A (No Action)	Alternative B and C	Alternative D	Alternative E
Whitebark Pine (WBP), Candidate species	**Potential Habitat Quality**: no change from current condition. Habitat improvement occurs at current level; 93% of white bark pine stands are in areas considered to be low risk for ground disturbance, and with restricted or limited restoration potential by mechanical treatment but increased influence of wildland fire. **Threats:** Threats are generally due to ecological and biological processes, but plan direction allows restoration at current level and plan components do not contribute to Federal listing. **Effects Determination**: Some active treatment related plan components may impact individuals but would not contribute toward a trend for Federal listing or loss of viability. Active restoration management activity would have beneficial impact.	**Potential Habitat Quality**: Plan components increase habitat quality. Increased habitat quality improvements expected under this alternative over Alt A specified by plan components; 93% of white bark pine are in areas considered to be low risk for ground disturbance, and with reduced or limited restoration potential by mechanical treatment but increased influence of wildland fire **Threats:** Threats are generally due to ecological and biological processes, but plan direction allows restoration at current level and plan components do not contribute to Federal listing. **Effects Determination**: Some active treatment related plan components may impact individuals but would not contribute toward a trend for Federal listing or loss of viability. Active restoration management activity would have beneficial impact.	**Potential Habitat Quality**: Plan components increase habitat quality. Increased habitat quality improvements expected under this alternative over Alts A, B, C, and E specified by plan components; 94% of white bark pine stands are in areas considered to be low risk for ground disturbance and with restricted or limited restoration potential by mechanical treatment but increased influence of wildland fire **Threats:** Threats are generally due to ecological and biological processes, but plan direction allows restoration at current level and plan components do not contribute to Federal listing. **Effects Determination**: Some active treatment related plan components may impact individuals but would not contribute toward a trend for Federal listing or loss of viability. Active restoration management activity would have beneficial impact.	**Potential Habitat Quality:** Plan components increase habitat quality. **White Bark Pine:** Increased habitat quality improvements expected under this alternative over Alt A specified by plan components; 93% of stands are in areas considered to be low risk for ground disturbance and with restricted or limited restoration potential by mechanical treatment but increased influence of wildland fire **Threats:** Threats are generally due to ecological and biological processes, but plan direction allows restoration at current level and plan components do not contribute to Federal listing. **Effects Determination**: Some active treatment related plan components may impact individuals but would not contribute toward a trend for Federal listing or loss of viability. Active restoration management activity would have beneficial impact.

Species Category	Alternative A (No Action)	Alternative B and C	Alternative D	Alternative E
Species of Conservation Concern **(Alt's. B-E)** (25 species & 145 occurrences)	Not applicable	**Potential Habitat Quality**: Plan components increase habitat quality. About 67% (Alt. B) and 68% (Alt. C) of the national forest is considered low risk for ground-disturbing threats. **Threats:** Nine species and 18% known occurrences have reduced threats overall in these low risk areas. Potential weed spread from vectors associated with motorized routes in alternative B will remain the same as under alternatives A and E. Potential weed spread from vectors associated with motorized routes in alternative C will have reduced threats from invasive weed competition since motorized routes are reduced by 14 miles when compared to alternatives A, B, and E. Revised plan components decrease threats and mitigate associated ground disturbing activities. **Effects Determination**: Course and fine filter plan components provide the ecological conditions to support long-term persistence within the plan area.	**Potential Habitat Quality**: Plan components increase habitat quality. About 70% of the national forest is considered low risk for ground-disturbing threats. **Threats:** Nine species and 23% known occurrences have reduced threats overall in these low risk areas. Potential weed spread from vectors associated with motorized routes in alternative C will have reduced threats from invasive weed competition since motorized routes are reduced by 182 miles when compared to alternatives A, B, and E. Revised plan components decrease threats and mitigate associated ground disturbing activities. **Effects Determination**: Course and fine filter plan components provide the ecological conditions to support long-term persistence within the plan area.	**Potential Habitat Quality**: Plan components increase habitat quality. About 67% of the national forest is considered low risk for ground-disturbing threats. **Threats:** Nine species and 18% known occurrences have reduced threats overall in these low risk areas. Potential weed spread from vectors associated with motorized routes in alternative E will remain the same as under alternatives A and B. Revised plan components decrease threats and mitigate associated ground disturbing activities. **Effects Determination**: Course and fine filter plan components provide the ecological conditions to support long-term persistence within the plan area.

Alternative A represents the current plans' future projections if kept

The determinations above are supported by the following rationale:

- All at-risk species (whitebark pine and species of conservation concern species) would be protected under policy and plan direction under the revised plan alternatives. The Regional Forester's sensitive species that are not included as an at risk species have been determined to lack threats to persistence on the Custer Gallatin due to various reasons or are not known to occur on the national forest.
- No specific vegetation-disturbing activities that would affect at-risk plant occurrences are proposed under any of the programmatic revised plan alternatives. Ground-disturbing activities would be considered in a separate environmental analysis prior to implementation.
- Minor effects to a small percentage of sensitive or at-risk habitats on the Custer Gallatin would not affect species persistence or suitability of the habitats present given plan components under any alternative.
- Although potential threats to at-risk plant habitat guilds from weed invasion are increased under Alternative E (due to decreased treatment objectives) when compared to the other revised plan alternatives, specific plan language targets emphasis of treatments in and near known occurrences of at-risk plants which supports restoration in known locations.
- Policy and plan components under the current plans protects known sensitive plant occurrences and habitats. Plan components under the revised plan alternatives provides ecological conditions to maintain known at-risk plant occurrences and habitats that persists and is resilient and adaptable to stressors (see Appendix C for at-risk species plan components).

3.6 Terrestrial Vegetation

3.6.1 Introduction

The Custer Gallatin National Forest covers approximately 3,039,000 acres. For planning purposes, the revised plan arranges the Forest into six distinct geographic areas ranging from roughly 78,000 acres to 1.4 million acres. Ecologically, the Custer Gallatin has termed its mountainous area as "montane" and the eastern districts as "pine savanna." Montane ecosystems of the Custer Gallatin include the Madison, Henrys Lake and Gallatin Mountains Geographic Area; the Absaroka Beartooth Mountains Geographic Area; the Bridger, Bangtail, and Crazy Mountains Geographic Area; and Pryor Mountain Geographic Area. The pine savanna ecosystem includes the Ashland and the Sioux Geographic Areas.

These two ecosystem areas are nested within the broader ecoregions (Environmental Protection Agency Level III Ecoregions). An ecoregion provides a larger scale for planning and analysis that distinguishes common climatic and vegetation characteristics. Approximately 81 percent of the Custer Gallatin National Forest is in the Middle Rockies consisting of coniferous forest, alpine meadow, and shrubland-grassland steppe. Approximately 19 percent of the Custer Gallatin is in the Northwest Great Plains Province consisting of ponderosa pine – shrubland-grassland steppe. A small amount (less than 1 percent) is in the Wyoming Basin province around the Pryor Mountains consisting of semi- desert shrubland-grassland.

The montane area is characterized by generally glaciated regions with altitudinal zonation of semidesert vegetation, coniferous forests on the lower mountain slopes, and alpine tundra toward the top.

Temperature and snowfall vary greatly with altitude. Winds are from the west/southwest, with much of their moisture precipitated where they cross the Pacific ranges. Due to aridity, forests are usually restricted to northern and eastern slopes at lower elevations. Although south- and west-facing slopes receive comparable precipitation, they are hotter and evaporation is higher. Consequently, they support fewer trees and are covered by shrubs and grasses. Lodgepole pine, Douglas-fir, subalpine fir, Engelmann spruce, limber pine, and whitebark pine are the predominant conifer vegetation. The lower slopes of the mountains are dominated by grasslands and shrublands.

The pine savanna area is characterized by rolling plains and tablelands of moderate relief. The plains are notably flat, but there are occasional valleys, canyons, and buttes. Badlands and isolated mountains break the continuity of the plains. The area lies in the rain shadow east of the Rocky Mountains. The climate is a semiarid continental regime. Winters are cold and dry, and summers are warm to hot. Evaporation usually exceeds precipitation, and the total supply of moisture is low. Vegetation is a formation class of short grasses usually bunched and sparsely distributed. Scattered shrubs, such as sagebrush, are supported in all gradations of cover, from semidesert to woodland. Many species of grasses and forbs grow in this area. Grasses include grama, wheatgrass, and needlegrass. On the driest sites ponderosa pine is short and generally open grown with grass understories. Moist north-facing sites have dense stands of taller ponderosa pine, with shrub and forb understories, including species of the mountain forests to the west. Draws and gullies (ravines) that support many hardwood trees (green ash, box elder, aspen) and shrubs (wild plum, hawthorn, silver buffaloberry, and snowberry) also dissect the landscape.

Regulatory Framework

2012 Planning Rule (36 CFR 219): Sets out the planning requirements for developing, amending, and revising land management plans for units of the National Forest System, as required by the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976 (16 U.S.C. 1600 et seq). This subpart also sets out the requirements for plan components and other content in land management plans. This part is applicable to all units of the National Forest System as defined by 16 U.S.C. 1609 or subsequent statute.

Clean Water Act of 1948, as amended: This act is the principal law concerned with polluting activity in the nation's streams, lakes, and estuaries. Originally enacted in 1948, it has been revised by amendments in 1972 (Pub. L. 92-500) that gave the act its current form and spelled out ambitious programs for water quality improvements that are now being put in place by industries and cities. Congress refined these amendments in 1977 (Pub. L. 95-217) and 1981 (Pub. L. 97-117). The 1987 amendments added:

- Section 319, under which States are required to develop and implement programs to control non-point sources of pollution, or rainfall runoff from farm and urban areas as well as construction, forestry, and mining sites.
- Section 303(d), which requires states to identify pollutant-impaired water segments and develop total maximum daily loads (TMDLs) that set the maximum amount of pollution that a waterbody can receive without violating water quality standards; develop a water-quality classification of streams and lakes to show support of beneficial uses; and establish anti-degradation policies that protect water quality and stream conditions in systems where existing conditions exceed standards.

Endangered Species Act of 1973, as amended: Directs Federal agencies to conserve threatened and endangered species and to ensure that actions authorized, funded, or carried out by agencies are not likely to jeopardize the continued existence of these species or result in the destruction or adverse modification of their critical habitats.

Federal Clean Air Act of 1955 (as amended in 1967, 1970, 1977, and 1990): The act is a legal mandate designed to protect air quality in the interests of public health and welfare. Although this policy creates the foundation for air quality regulation, states and counties are often responsible for implementation of the air quality standards. The task of identifying National Ambient Air Quality Standards is assigned by the Clean Air Act to the Environmental Protection Agency. The Environmental Protection Agency evaluates and updates these standards every 5 years. This act provides for the protection and improvement of the nation's air resources and applies to the effects of wildland fire and can help inform wildfire response.

Multiple-Use Sustained-Yield Act of 1960: Congress has affirmed the application of sustainability to the broad range of resources over which the Forest Service has responsibility. The Multiple-Use Sustained-Yield Act confirms the Forest Service' authority to manage the national forests and grasslands "for outdoor recreation, range, timber, watershed, and wildlife and fish purposes" (16 U.S.C. 528) and does so without limiting the Forest Service' broad discretion in determining the appropriate resource emphasis or levels of use of the lands of each national forest and grassland.

National Environmental Policy Act of 1969: Requires analysis of projects to ensure the anticipated effects upon all resources within the project area are considered prior to project implementation (40 CFR 1502.16). This act declares that it is a Federal policy to "preserve important historic, cultural, and natural aspects of our national heritage". It requires Federal agencies to use a systematic and interdisciplinary approach that incorporates the natural and social sciences in any planning and decision making that may impact our environment.

National Forest Management Act of 1976: "It is the policy of the Congress that all forested lands in the National Forest System shall be maintained in appropriate forest cover with species of trees, degree of stocking, rate of growth, and conditions of stand designed to secure the maximum benefits of multiple use sustained yields. Plans developed shall provide for the diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet the overall multiple-use objectives, and within the multiple-use objective."

Organic Administration Act of 1897: Provides the main statutory basis for the management of forest reserves. States that the intention of the forest reserves (which later were called national forests) was to "improve and protect the forest" and to secure "favorable conditions of water flows" and provide a "continuous supply of timber for the use and necessities of citizens of the United States." This act also authorizes the Secretary of Agriculture to designate experimental forests and ranges, and to set forth broad direction for establishing and administering these areas.

Secure Rural Schools and Community Self-Determination Act of October 30, 2000 (P. L. 106-393, 114 Stat. 1607; 16 U.S.C.500 note): This act provides provisions to make additional investments in, and create additional employment opportunities through, projects that improve the maintenance of existing infrastructure, implement stewardship objectives that enhance forest ecosystems, and restore and improve land health and water quality. This act was designed to stabilize annual payments to state and counties containing National Forest System lands and public domain lands managed by the Bureau of Land Management. Funds distributed under the provisions of this act are for the benefit of public schools, roads, and related purposes.

Wilderness Act (1964) (16 U.S.C. 1131-1136): This act provides the statutory definition of wilderness and management requirements for these congressionally designated areas. This act established a National Wilderness Preservation System to be administered in such a manner as to leave these areas unimpaired for future use and enjoyment as wilderness.

Key Indicators and Measures

Ecosystem integrity is typically assessed by considering dominant ecosystem components including function, composition, structure and connectivity (Andreasen et al. 2001). *Composition* refers to attributes associated with the species within an ecosystem, such as species dominance, richness or evenness. *Structure* generally refers to physical features, such as stand density or tree size. *Function* encompasses ecological processes such as herbivory, succession and fire. *Connectivity* denotes the degree to which the landscape facilitates or impedes movement among resource patches.

Specific key ecosystem characteristics representing ecological function, composition, structure and connectivity have been identified and serve as the key indicators for describing the affected environment and evaluating differences among the alternatives. Key ecosystem characteristics are also chosen because they are measurable (for example, quantitative or qualitatively) and there is data or means to distinguish and describe them. Differences among the alternatives may be expressed as both qualitative and quantitative, and the estimated changes in key ecosystem characteristics over time serve as the basis for evaluation of ecological sustainability and forest resilience. The key indicators discussed in this section of the environmental impact statement for vegetation are listed below. Although connectivity is primarily addressed in the wildlife section, the discussion below of landscape pattern as a structural element of ecosystems is also an important component of managing for connectivity. Descriptions of indicators and how they are measured are provided in their respective sections. Table 30 lists key ecosystem components and indicators.

Table 30. Terrestrial vegetation key ecosystem characteristics

Ecosystem Component	Key Ecosystem Characteristic	Indicator(s)
Function	Insect disturbance	Hazard ratings for mountain pine beetle, Douglas-fir beetle, western spruce budworm, and root disease
Function	Wildfire disturbance	Fire frequency by severity class
Function	Invasive species	Vulnerable Habitats
Composition	Vegetation composition	Cover types (forested and non-forested)
Composition	Tree species presence	Presence of at least 1 tree per acre
Structure	Dead trees (snags)	Classes based on diameter classes
Structure	Tree size	Classes based on basal area weighted diameter
Structure	Large tree structure	Presence of a set minimum of large trees per acre
Structure	Tree density	Classes based on canopy cover
Structure / Connectivity	Landscape pattern	Patch composition, size and distribution

Methodology and Analysis Process

Ecological Integrity

As required by the 2012 Planning Rule, the forest plan is using the concept of *ecological integrity* as a guiding framework to plan for social, ecological and economic sustainability. The rule defines ecological integrity as the quality or condition of an ecosystem when its dominant ecological characteristics (for example, composition, structure, function and connectivity) occur within the natural range of variation and can withstand and recover from most perturbations imposed by natural environmental dynamics or human influence (36 CFR 219.19). Notably, by specifically capturing the ability of ecosystems to "withstand and recover from most perturbations," this definition of ecological integrity describes resilience as a fundamental component of ecological integrity.

Ecological integrity forms a crucial part of the plan's "coarse-filter" approach for a biodiversity conservation strategy – for example, a habitat-based approach, versus species-specific management (Hunter et al. 1988). A key assumption of this approach is that intact ecological conditions mean habitats, and the species dependent on them, persist. Moreover, it is assumed that by maintaining these conditions, critical ecological and evolutionary processes such as nutrient and sediment transport, biotic interactions, dispersal, gene flow and disturbance regimes, will also be maintained and provide the necessary environmental conditions for climate adaptation (Beier and Brost 2010).

Wurtzebach et al. (2018) outline some key characteristics and assumptions associated with the ecological integrity framework. They note that ecological integrity:

- Emphasizes the importance of ecological processes such as natural disturbance regimes that provide the structures and functions on which the full complement of species in an ecosystem or landscape depend.
- Assumes that ecological systems that retain their native species and natural processes are more resistant and resilient to natural and anthropogenic stresses over time (including climate change).
- Emphasizes the intrinsic value of native biodiversity, beyond its functional role in supporting the renewal and reorganization of ecosystem function and structure over time
- Uses the natural or historic range of variation as a reference point for promoting resilience (the capacity to reorganize while undergoing change to still retain essentially the same function, structure, identity, and feedbacks).

Consistent with this conceptual framework, desired conditions for vegetation were developed to provide for the ecological integrity of Custer Gallatin National Forest ecosystems. Desired conditions were based on an analysis of the natural range of variation while also considering current and future stressors. Standards, guidelines and objectives were developed if necessary to move toward or maintain desired conditions. These plan components form the basis for comparison of alternatives.

Natural Range of Variation

Consistent with the framework of managing for ecological integrity, a key assumption underlying plan development is that the natural range of variation provides insight and a frame of reference for evaluation of ecological integrity and resilience (Wiens et al. 2012). As such, the development of desired conditions are based on a careful consideration of the natural range of variation for key ecosystem components.

It is assumed that the natural range of variation reflects the ecosystem conditions that have sustained the current complement of wildlife and plant species on the Custer Gallatin, and provides context for understanding the natural diversity of the vegetation and what processes sustain vegetation productivity and diversity (Keane et al. 2009). Though humans have shaped the ecosystems of the Custer Gallatin for thousands of years, since the 1800s human presence and activities have increased dramatically, along with associated impacts to ecosystem conditions. Natural range of variation estimates provide a reference for conditions that might have occurred prior to this recent increase in human impacts. Additional factors considered in the development of desired conditions included climate change, the existing or anticipated human use patterns or desires for specific vegetation conditions, and the ecosystem services desired and expected from Forest lands (such as reducing fire hazard and producing forest products).

Potential Vegetation Types

To stratify and structure the analysis of the terrestrial vegetation, and changes associated with the different management alternatives, two types of vegetation classification were used: potential vegetation and existing vegetation. Potential vegetation type, also called habitat types (Pfister et al. 1977b), is the plant community that would be expected under existing environmental conditions in the absence of significant disturbance or human involvement (for example, climax vegetation type). Potential vegetation provides a basis for identifying and mapping unique biophysical conditions (Pfister et al. 1977b) which can form as the basis of understanding ecological dynamics including successional development (Arno et al. 1985), fire regimes (Barrett 1988, Morgan et al. 2001) and site productivity (Milner 1992). Some have noted important limitations of the potential vegetation concept (Chiarucci et al. 2010). While there are theoretical and practical limitations to the use of potential vegetation types, the concept is nevertheless extremely powerful when used correctly and key assumptions are well understood (Somodi et al. 2012). For this reason, potential vegetation classifications have been developed for many areas in the United States and are actively used for numerous management applications including the LANDFIRE project (Rollins and Frame 2006) and the Forest Vegetation Simulator (Dixon 2008).

The Forest Service’s Northern Region has identified potential vegetation groups that are recommended for use at broad spatial scales to facilitate consistent analysis and monitoring (Milburn et al. 2015). These groups are used in the Custer Gallatin National Forest revised forest plan with some minor adjustments as described in Reid et al. (2018)(Reid et al. 2016). The three broad forested potential vegetation types found on the Custer Gallatin are Warm Dry, Cool Moist, and Cold. For this analysis, the Warm Dry potential vegetation type was divided in to two types: Warm Dry - Montane and Warm Dry – Pine Savanna. This was done to better capture the significant compositional and biophysical differences between the montane and pine savanna ecosystems. Potential vegetation types provide the basis of land classification for development of desired conditions and other plan components.

For modeling and analysis, it was necessary to map the distribution of potential vegetation types across the Custer Gallatin. The potential vegetation type map used for this document was developed by the Northern Region in the early 2000s (Jones 2004). Sources of data included field plots and remote sensing. Lands with no field data were populated by extrapolation of plot data and the use of models that integrated site factors influencing vegetation, such as precipitation, slope and elevation. This layer, referred to as *R1 Potential Vegetation Types* or *R1-PVT,* is the best available potential vegetation type layer. It is the only map of potential vegetation that covers the national forest, and is a mid-level depiction of ecological condition. When necessary potential vegetation classifications were adjusted to be consistent with current vegetation maps. This logic is available in Reid et al. (2018). Table 31 displays the proportion of Northern Region Broad Potential Vegetation Types in each geographic area.

Table 31. Distribution by percentage of Northern Region Broad Potential Vegetation Types on the Custer Gallatin National Forest by geographic area

Region 1 Broad Potential Vegetation Types	Sioux	Ashland	Pryor Mountains	Absaroka Beartooth Mountains	Bridger, Bangtail, Crazy Mountain	Madison, Henrys Lake, Gallatin Mountains
Alpine	0 %	0	0	8	0	2
Cold	0 %	0	1	21	4	13
Cool Moist	0 %	0	15	26	39	54
Grassland	52 %	45	32	7	10	7
Riparian/Wetland	1 %	1	1	1	1	1
Shrubland/Woodland	4 %	4	7	1	1	3
Sparse	2 %	1	1	21	17	7
Warm Dry	41 %	50	43	15	29	13

Climate Change Considerations and Assumptions

Climate change is expected to continue and have profound effects on the Earth's ecosystems in the coming decades (IPCC 2007). Description and analysis of these effects relied on a broad array of recent scientific literature and in particular a recent meta-analysis of climate change and potential effects published for the Northern Region Adaptation Partnership (Halofsky et al. 2018a;b). Halofsky et al. (2018a, 2018b), and the references cited therein, represent the current state of the science on the effects of climate change in the region and is the source for much of the information in this section and throughout the document. In addition, to better understand the effects of climate change at a more local scale, the Custer Gallatin Plan Revision Team collaborated in a series of workshops with a diverse team of scientists and land managers from universities, government agencies and non-governmental agencies to specifically review and assess the revised plan's approach to climate change. The results of this effort are discussed in more detail below and are also available at Hansen et al. (2018).

As summarized by Halofsky et al. (2018a, 2018b), there is little debate that atmospheric carbon dioxide is increasing and that this increase will cause major changes in climate but there is a great deal of uncertainty about the magnitude and rate of climate change, especially as projections are made at more local scales or for longer time periods. Despite the uncertainty in downscaled projections, scientists expect the impacts of climate change on forest vegetation to be primarily driven by vegetation responses to shifts in disturbance regimes, and then secondarily, through direct effects of vegetation interactions with climate through shifts in regeneration, growth, and mortality processes at both individual plant and community scales. Increased temperatures will result in a reduction in water available to trees and understory plants. Trees will respond to reduced water availability, higher temperatures, and changes in growing season length in diverse manners. Changes in vegetation composition and structure will be the result of changes in both the life cycle processes and responses of a plant to disturbance.

The Northern Region Adaptation Partnership assessed projected climate change responses for 17 tree species, five forest vegetation types, and three resources of concern: landscape heterogeneity, carbon sequestration and timber production. Using the past, current, and future assessments, and the study rated the vulnerability of these elements to climate change. Vulnerability was determined from a number of factors including stressors, exposure, sensitivity to climate change, impact of that response, and adaptive capacity. Vulnerability assessments for the Northern Rockies were also done by Hansen and Phillips (2015), based on the results of five previous studies, and by Piekielek et al. (2015) for the Greater Yellowstone Area (table 32). The assessments are in broad agreement that subalpine tree species are most vulnerable to climate change, particularly whitebark pine, subalpine fir, and lodgepole pine. With warming, suitable habitat for these species shifts to higher elevations and have less total area. Lower elevation forests are also vulnerable with the Douglas-fir zone in the Greater Yellowstone Area being increasingly suitable for juniper and sagebrush communities. Forests at all elevations are projected to have increased outbreaks of forest pest species and more frequent fire.

Table 32. Ranking of vulnerability of tree species in the Northern Rockies and the Greater Yellowstone Area. A ranking of "1" indicates the highest vulnerability

Species	Northern Region Adaptation Partnership 2018 Northern Rockies	Northern Region Adaptation Partnership 2018 Greater Yellowstone Area	Hansen and Phillips 2014 Northern Rockies	Piekielek et al. 2015 Greater Yellowstone Area
Whitebark pine	2	1	1	1
Douglas-fir	5	2	9	5
Engelmann spruce	9	4	5	2
Subalpine fir	10	5	4	3
Lodgepole pine	11	6	3	4
Cottonwood	13	3	not applicable	not applicable
Aspen	14	7	not applicable	6
Limber pine	15	8	not applicable	7
Ponderosa Pine	17	9	10	not applicable
Green ash	18	10	not applicable	not applicable

Considerable uncertainties underlay these projections of vegetation under future climates, including:

- Complex interactions of climate with vegetation and disturbance are difficult to predict in time and space making future projections difficult;
- Abundant scale problems in nature and in the literature that made it difficult to generalize species and ecosystem trends at consistent temporal and spatial scale;
- Uncertainty in climate projections (22 general circulation models, 6 scenarios) made it difficult to project climate change responses at the local level.

Most models predict that northern latitudes will warm while maintaining or increasing precipitation. This combination of factors should enhance productivity on northern and high-altitude rangelands through increased growing seasons for some time. If temperatures continue to rise, however, as suggested in all of the Resources Planning Act climate projections (U.S. Department of Agriculture 2012b), gains in production related to longer growing seasons and increased precipitation may be offset by decreased moisture availability at some time in the future. Despite this possibility, recent research suggests that increased temperatures, when coupled with increased carbon dioxide, actually improve plant water relations because of decreased transpirational demand (Morgan et al. 2011).

Although the vegetation cover types will change with time, habitat types (potential vegetation types) will remain relatively stable because they are based on physical site factors. However, with climate change and shifts in moisture, temperature and other factors, potential vegetation types may change over time. Over the next 50 years, certain environmental influences may negatively impact non-forested vegetation condition and forage production. If temperatures continue to increase, there may be changes in vegetation, shifting from more mesic plant associations to more xeric communities, better adapted to the drier sites. Invasive weeds may continue to spread and increase in abundance and density. Timber canopy may continue to close in areas where wildfires or other disturbances do not occur, and some grasslands/shrublands may see additional conifer colonization and shift to a timber-dominated community. Conversely, there is potential that wildfire may play a larger role in shaping vegetation in some areas, perhaps promoting non-forested vegetation communities, particularly given warmer climate regimes. Fire and climate play primary roles in shaping vegetative types and conditions on the Northern Great Plains (Higgins 1984), which includes the Sioux and Ashland geographic areas. Transitory range acreage will fluctuate: timber stands will become more open due to harvest, insects, and/or fire; with time and succession, overstory canopies will close in once again.

Studies indicate that 20th century measures of climate, including drought, represent only a subset of the full range of conditions experienced in the past as a result of natural variation. Although drivers and feedback mechanisms are not fully understood, there is sufficient indication from past climate records and future projections to prioritize development of effective strategies for coping with the consequences of more frequent, more severe, and longer drought (Halofsky et al. 2018b;c).

Although it is difficult to model a detailed picture predicting the occurrence and extent of future drought, higher temperatures will increase the severity of drought episodes when they occur. Higher temperatures will reduce soil moisture critical to plant productivity, species composition, and erosion potential (Polley et al. 2013). Models of net primary productivity predict overall better growing conditions for the Northern Great Plains (Polley et al. 2013, Reeves et al. 2014) which may have an influence on the Ashland and Sioux Districts.

Drought has always impacted the physical environment and will continue to do so. In the Western United States there is a trend toward dry conditions (Vose et al. 2016). Uncertainty arises primarily from limited capacity to predict future precipitation changes, particularly long-term lapses in precipitation. Despite this uncertainty, there is growing consensus that extreme precipitation events (such as, lapses in precipitation and more intense storms) will increase in frequency, and warmer temperatures will exacerbate the impacts of drought on forests and rangelands in the future (Vose et al. 2016). Although models predict overall better growing conditions for productivity in the Northern Great Plains, drought in rangelands could reduce forage and water available for livestock grazing and wildlife use. Reduced vegetative cover can lead to wind and water erosion. Drought often affects wildfire-related disturbance. In addition, droughts are predicted to accelerate the pace of invasion by some nonnative plant species into rangelands.

Warmer temperatures will likely result in increased fire frequency and intensity, creating more favorable conditions for invasive species, which would likely decrease overall forage quantity, quality and biodiversity. Management schemes will need to continue to be flexible and sensitive to changes in species composition.

Frequent low-severity drought that selectively favors more drought-tolerant species could create rangelands better adapted to future conditions without the need for management intervention. By contrast, severe drought (especially in combination with insect outbreaks or fire), may threaten large-scale changes that warrant substantial management responses. Actions could range from reducing vulnerability, facilitating post-drought recovery, or facilitating a transition to a new condition. Grazing practices need to continue to adapt to changing drought regimes.

Management actions can either mitigate or exacerbate the effects of drought. A first principal for increasing resilience and adaptation would be to avoid management actions that exacerbate the effects of current or future drought. Options can include altering structural or functional components of vegetation, minimizing drought-mediated disturbance such as wildfire or insect outbreaks, and managing for reliable flow of water.

The draft revised forest plan and this environmental impact statement incorporate models, plan components, and resource management strategies developed using the latest understanding of climate and potential changes into the future. Based on Halofsky et al. (2018a), important trends and projections in climate include:

Montane Ecosystems:

- Over the historical period of record (1895–2012), the annual mean monthly minimum temperature increased by about 2.9 degrees Fahrenheit, while the annual mean monthly maximum temperature increased by about 1.2 degrees Fahrenheit.
- By 2100, annual mean monthly minimum temperatures are projected to increase 5 to 10 degrees Fahrenheit while the annual mean monthly maximum temperatures are projected to increase 7 to 12 degrees Fahrenheit.
- Annual mean monthly precipitation is projected to increase slightly by 2100, although projections for precipitation have high uncertainty compared to temperature projections.
- Winter maximum temperature is projected to increase above freezing in the mid-21st century. Summer temperatures are projected to increase 5 degrees Fahrenheit by 2060 and 10 degrees by 2100.

Pine Savanna Ecosystems:

- Warming trends indicate that future climate will be similar to the Montane Ecosystems described above.
- Even with little or no change in precipitation, there is the potential for summer drying or drought due to the increased heat and increased evapotranspiration.

Revised forest plan direction incorporates strategies to address the uncertainties associated with climate change and its potential impacts to vegetation. While many effects of climate change are anticipated to be gradual, there is also the potential for interacting disturbances such as insects, drought and fire to drive systems towards sudden large-scale transformations (Millar and Stephenson 2015). For example, dry forests that already occur at the edge of their climatic tolerance are increasingly prone to conversion to non-forests after wildfires due to regeneration failure (Stevens-Rumann et al. 2018). This trend is likely to continue in the future across all forest types as large wildfires remove local seed source and suitable climate space for tree regeneration becomes increasingly rare (Bell et al. 2014, Harvey et al. 2016b, Andrus et al. 2018). Indeed, the ponderosa pine systems of the pine savanna ecosystems have experienced high rates of cover type conversion due to recent fires. In Ashland, for example, in the 1990s approximately 219,214 acres were classified with forest cover, in 2012 approximately 116,708 acres were classified as forested. The net change is an almost 50 percent reduction of the forest cover from what occurred in the 1990s (U.S. Department of Agriculture 2014). While most of this area will likely regenerate naturally or with planting efforts, it is likely that a significant portion will remain unforested for at least the next few decades due to a lack of seed source. Desired conditions outlined in the plan are designed to make these forests more resilient to future wildfire and thereby mitigate the potential for large-scale loss of ecosystem services (Millar and Stephenson 2015).

Approaches to address forest and ecosystem management in the face of an uncertain and variable future should be flexible, emphasize ecological processes; and have the capacity to change, and to adapt, to new information as it becomes available (Millar et al. 2007). Approaches commonly published in the literature include promoting resilience to change, creating resistance to change, and enabling forests to respond to change (Holling 1973, Millar et al. 2007, Janowiak et al. 2014, Halofsky et al. 2018a;b;in press). *Resilience* is defined as the degree to which forests and ecosystems can recover from one or more disturbances without a major shift in composition or function, and is the most commonly suggested adaptation option discussed in a climate-change context (Millar et al. 2007). Resilient forests accommodate gradual changes related to climate and are able to cope with disturbances. *Resistance* is the ability of the forest or ecosystem to withstand disturbances without significant loss of structure or function, in other words, to remain unchanged. From a management perspective, resistance includes both the degree to which communities are able to resist change, such as from warming climate; and the manipulation of the physical environment to counteract and resist physical or biological change, such as through burning or harvest treatments (Halofsky et al. 2018a). The *response* approach intentionally accommodates change rather than resists it, with a goal of enabling or facilitating forest ecosystems to respond adaptively as environmental changes accrue. Treatments would mimic, assist or enable ongoing natural adaptive processes, anticipating events outside the historical conditions, such as extended fire seasons or increased summer water deficits. Response tactics may include such practices as shifting desired species to new potentially more favorable sites through planting, managing early successional forests to “reset” normal successional trajectories to create desired future patterns and structures, and promoting connected landscapes (Millar et al. 2007). No single approach will fit all situations, and integration of various adaptive approaches and management practices is the best strategy (Spittlehouse and Stewart 2003, Millar et al. 2007). A tactic or action may be consistent with two or three of the adaptive approaches.

For the development of the programmatic management direction in the revised forest plan, all approaches above are integrated to one degree or another, though promoting resilience is the primary approach. The resistance approach is integrated, for example with protection of highly valued habitats, species or other resources. Approaches that could be considered response options are promotion of landscape connectivity and treatments in young stands to develop desired future forest patterns and structures. Another key plan component that is critical in the context of future climate change is the establishment of a monitoring plan to inform an adaptive management approach. This enables the intentional use of monitoring to evaluate effectiveness of our plan direction and resulting management actions. For example, monitoring tree regeneration will provide critical information on possible climate change effects to this vulnerable life stage (Stevens-Rumann et al. 2018).

It is acknowledged that there is an incomplete understanding of both climate change and its potential impact to forests and ecosystems. To better understand the threats and vulnerabilities posed by climate change and examine how plan direction could promote adaptation strategies and tactics that promote resilience to changing climatic conditions, the Custer Gallatin National Forest worked with partners from other Federal agencies, universities and non-governmental organizations. A series of workshops in 2018 used best available scientific information to assess the vulnerability of potential vegetation types and cover types to projected climate change and identified and evaluated management options aimed at achieving or maintaining ecological integrity. The explicit goal of the project was to assess climate vulnerability of forest vegetation and evaluate management options in support of the Custer Gallatin National Forest Plan revision. Objectives of the effort included:

1. Assessing vulnerability to climate change of key ecosystem characteristics within broad potential vegetation types based on exposure, sensitivity, adaptive capacity.
2. Identifying ecological characteristics for which the stated desired condition is not appropriate given climate change.
3. Identifying and evaluating broad adaption strategies and management options for maintaining the ecological integrity of vulnerable vegetation types in the desired condition under climate change.
4. Evaluating the feasibility of these adaptation strategies and management options and prioritizing them relative to geographic location, need, effectiveness, and feasibility.

Results of this effort were used to inform and refine the development of desired conditions as well as provide important strategies and tactics, many of which are reflected in the Management Approaches (appendix A). The full report from this series of workshops is available in Hansen et al. (2018). The following are a few of the conclusions from workshop members that have been incorporated in to the revised plan, the management approaches (appendix A), or the analysis:

- Given uncertainty in some tree species tolerances to climate and soils and high uncertainty in future climate and vegetation response, adaptive management and experiments across biophysical gradients are needed for reducing uncertainty.
- Well-designed monitoring of climate, vegetation, and ecological conditions is important for tracking the condition of key response variables in the context of management and environmental change. Many vital signs of ecological integrity can now be harvested at low cost from remote sensing and other data sources. The Federal agencies present in the Greater Yellowstone Ecosystem are all doing some level of monitoring and coordination among them is most likely to lead to robust monitoring across the ecosystem.
- It is important to not only identify potential ecological consequences of climate change, but to prioritize the changes to identify which are most important for management action. Relatedly, any recommendations will make will be more likely to be effective if they are actionable by managers.
- While there is high uncertainty in projections of future climate and vegetation response, there is high agreement that some trends are likely and these should be considered by management. These include more fire, reduced soil moisture effects at lower elevations, warming effects at upper tree

line, reduced snowpack and river flows, and increased levels of pests such as bark beetles (such as, increased future fire in the Greater Yellowstone Ecosystem may be analogous to sea level rise in coastal areas, a very likely bet in the long-term). Assume the forest will burn more, that snow pack will decline, and the river flows will be reduced and manage accordingly. Temperature changes will overwhelm precipitation increases, particularly at lower tree line.

- The spatial and temporal patterns with which these trends are manifest may be gradual or episodic due to interactions among natural climate variation, human effects on climate, and random events. For example, the shifting upslope of lower tree line under warming may be gradual with drought induced tree mortality or episodic with a large, intense fire being a regime shift to the community. Management strategies should be robust relative to these varying types of change.
- Many of the tree species may be relatively resilient to projected climate with regards to regeneration and distribution. However, increased fire is likely to shift existing forests to younger age classes and smaller size classes. This would reduce the habitat qualities and ecosystem services associated with large trees and late seral forests.
- The Cold potential vegetation type spans a relatively wide range of climate conditions from dry to wet. Thus, vulnerability may vary within the Cold potential vegetation type and more landscape specific management approaches may be appropriate.
- Successful management of vegetation and ecosystems during this period of rapid environmental change will require “anticipatory” planning and management. Trends in climate, land use, invasives, recreation, etc. should be tracked past to present and forecast into the future so management strategies can be designed to help the ecosystem be resilient to the changes that may be happening in future decades. Plotting the natural range of variation from past periods, trends in condition in recent decades, and forecasted trends provides a context for vulnerability assessment and prioritizing management needs.

In summary, as noted by Halofsky et al. (2018a), a warming climate will rarely be the direct agent of change for terrestrial vegetation on the Custer Gallatin National Forest. Rather, most of the changes will likely result from responses to climate change-induced disturbance or to some combination of other climate-exacerbated stressors. Whether it is invasive species (such as, white pine blister rust), drought, uncharacteristic wildfires, elevated native insect and disease levels, loss of fire-adapted trees, or unusually high forest densities, the most significant effect of climate change is likely to be further exacerbating these stressors and “stress complexes”. Plan direction, which emphasizes ecological integrity and resilience, will be critical to minimizing the undesirable effects of these increasing and interacting stressors. Nevertheless, managers and the public should expect climate change to drive profound and often surprising changes on ecosystem structure, function and composition in the coming decades.

Vegetation Modeling

This analysis relies on analytical vegetation models to assess both natural range of variation and the potential effects of plan direction on future vegetation conditions. It is important to understand the strengths and limitations of the analytical models to appropriately interpret the results. Out of necessity, the models simplify very complex and dynamic relationships between ecosystem processes and drivers (such as climate, fire and succession) and vegetation over time and space. The models use a given set of assumptions, including fire regimes, insect or disease activity, the rate of tree growth, stand structure change over time (succession), etc. These assumptions are based on analysis and corroboration of actual data (such as fire history and historical vegetation information) and review of scientific literature, as well as professional judgement and experience of resource specialists familiar with the ecosystems and forest types of the Custer Gallatin. Though best available information and knowledge is used to build these models, there is nevertheless a high degree of variability and uncertainty associated with the model results because of the ecological complexity and imperfect knowledge of system dynamics. When modeling future conditions, the precise timing, magnitude and location of disturbances will differ from that modeled, resulting in different effects to vegetation compared to model outputs. As such, while model results provide a good indication of how vegetation may change over time, they are most useful for assessing broad ranges of ecosystem characteristics under historic disturbance regimes (for example, estimating the natural range of variability) and for comparing *relative* effects among alternatives. Moreover, although models are helpful, they are but one tool used to inform the analysis of effects in this environmental impact statement. Model outputs augment other sources of information, including research and professional knowledge of how ecosystem processes (such as succession) and disturbances/stressors (such as fire, insect, harvest, and climate) might influence changes in vegetation conditions over time, especially at the scale of the planning unit. All these sources of information are used in the evaluation of environmental consequences of the alternatives. Appendix B provides additional detail on vegetation modeling and methodologies.

Modeling Natural Range of Variation

To quantify the natural range of variation, modeling was done to simulate vegetation conditions prior to European settlement. The best available model is *SIMulating Patterns and Processes at Landscape scaLEs* (SIMPPLLE) Version 1.4.0 (September 2017). This model was developed in Region 1 to assess landscape-level management questions. It is a spatially-explicit, dynamic landscape model used for projecting temporal changes in the spatial distribution of vegetation in response to insects, disease, wildland fire, and other disturbances (Chew et al. 2012a). The model is designed to provide a balance between incorporating enough complexity to provide an acceptable level of realism while making enough simplifications to be a useful management tool in planning processes.

One of the main utilities of the model is its stochastic nature. Managers cannot know with precision the specific types, locations, and extents of natural disturbances that will occur on the landscape. Therefore, the SIMPPLLE model will randomly assign fire, insect, and disease processes on the landscape in a manner consistent with what is known about the nature of these disturbances (such as, insect-prone stands have a higher hazard and probability of getting an infestation, especially in a dry climate cycle). The model is typically run for multiple iterations to allow the manager to see a variety of possible projections, look for patterns, and adjust management response accordingly.

The other main utility of the SIMPPLLE model is its spatially interactive nature. Landscape dynamics are inherently spatial. A process or condition occurring on one site is dependent, to an extent, on adjacent sites. Consider a fire event. SIMPPLLE simulates fire by assigning fire *starts* with a probability consistent with what historic records indicate for the area and climate. Each start is then given the opportunity to grow. The size the fire grows to is dependent on the surrounding vegetation as well as the historic probability that it will end with a weather event (or, if simulating fire suppression, whether or not there are enough resources, etc. to put the fire out). The *severity* of fire that spreads (low, mixed or high) is dependent on the vegetation conditions of the site (including past disturbance or treatment), the climate, its elevational position relative to the burning fire (uphill, downhill, etc.) and whether it is downwind or not. Again, the fire process will stop according to the probability of a weather ending event, successful fire suppression, or perhaps it runs up against a natural barrier such as sparse vegetation or a lake. SIMPPLLE will then determine the *effect* of the fire by considering whether there are trees present capable of re-seeding/re-sprouting the site (in the case of a lethal fire), whether the stand's fuel conditions have been reduced (for semi- or non-lethal fires), and if there has been a change in size or species on the site.

The Custer Gallatin plan revision modeled vegetation conditions associated with climate conditions from AD 960 through 2000. This reference period allowed simulation of the conditions associated with much of the time period known as the Medieval Climate Anomaly as well as the other end of the climate spectrum known as the Little Ice Age. The inclusion of the Medieval Climate Anomaly in the simulation is potentially valuable in that it might indicate conditions and processes that could occur in the modern climate regime (Calder et al. 2015).

Details on data sources and key assumptions used in the natural range of variation modeling process can be found in appendix B. Several notable additional pathways and processes in the model were calibrated to accurately reflect the conditions on the Custer Gallatin National Forest specifically, including:

- Successional Pathways: Successional pathways are state and transitional models for each vegetation type that provide the foundation for the model. The existing data was reviewed, and pathways for both forested and non-forested vegetation types were added and/or modified based on expert judgment, measured vegetation conditions from forest inventory and analysis datasets and successional theory literature to ensure the model depicted the conditions found on the Custer Gallatin National Forest.
- Wildfire Processes: Wildfire processes, including the probability of ignition, fire sizes, fire regimes (severities), weather ending events, and effects to successional pathways are key drivers in the model. Wildfire processes were calibrated using LANDFIRE data, applicable fire history studies and publications, previous modeling efforts, and expert judgment.
- Insect and Disease Processes: The probability and effects of key insect and disease processes (bark beetles, defoliators, and root diseases) were also calibrated using the latest science regarding insect hazard and mortality trends, local data, and expert judgment.

Modeling Vegetation Change during the Planning Period

Vegetation across the Custer Gallatin will change over time, in response to both natural ecological disturbances (such as fire and insects), human elements (such as timber harvest and prescribed burning), and the interaction of these factors with vegetation succession and climate. The desired condition is to maintain vegetation conditions within the desired ranges over time to contribute to forest and ecosystem resilience and sustainability.

Modeling of future vegetation change was done in two steps. First, PRISM (Plan-level forest activity scheduling model) (Nguyen 2018) a linear programming model, was used to project alternative forest management scenarios, schedule vegetation treatments, and provide outcomes; based upon a variety of input parameters, such as management objectives and budget limitations. PRISM was also used to project timber harvest acres and volumes over time under different management scenarios. Appendix B describes the PRISM analysis process in detail, and the resulting timber harvest outputs. Next, the SIMPPLLE model was used to simulate fire, insect and disease disturbances over time (historical and future), and the interaction of these disturbances with vegetative succession and treatment activities. The SIMPPLLE model provides for spatial analysis of landscape dynamics given future management activities as scheduled through the PRISM model. Appendix B and the planning record contain more information on the development and use of the SIMPPLLE model including the raw data outputs from the SIMPPLLE model.

In the PRISM model, vegetation management activities expected to occur over time in each alternative were formulated by considering the different objectives of each alternative coupled with land designations, land suitability, other resource limitations on treatments (such as within Canada lynx habitat or grizzly bear security core), projected fire and insect effects and budget limitations. For each of the alternatives, the PRISM model was run with a set of objectives and constraints that was in keeping with the theme of the alternative. The following summarizes key differences in PRISM model assumptions across alternatives, details of model assumptions can be found in appendix B.

- For all alternatives, the objective of the model was to trend vegetation conditions towards the desired conditions for vegetation.
- For all alternatives, the model was constrained by the minimum amount of saw timber volume to be produced. This range of timber volumes was selected to reflect a reasonable range of potential emphases in terms of vegetation treatment types for the Custer Gallatin National Forest vegetation management program. Timber volumes were used as a minimum constraint, the model was able to schedule higher volumes if doing so would accelerate the rate of achieving the desired vegetation conditions. See Timber section for additional detail.
- For all alternatives, PRISM was required to treat a minimum number of acres depending on the objectives of each alternative. This reflects the full range of treatment types (such as, planned ignitions, planting, and timber harvests). The model was allowed to choose which mix of treatments that most efficiently moved vegetation towards the desired conditions. Treatment acres were used as a minimum constraint, the model was able to schedule treating more acres if doing so would accelerate the rate of achieving the desired vegetation conditions while meeting all constraints.
- PRISM was constrained by budget assumptions. For alternatives A through D, the budget was assumed to be comparable to fiscal years 2012-2015. For alternative E, the budget for vegetation management was assumed to increase by 33 percent to analyze the effects of a higher level of timber volume. Rather than increasing the Forest's budget as whole, the increase in budget for vegetation management was assumed to come at the expense of other program areas and the effects of this are also discussed. All alternatives were also analyzed without a budget constraint.
- All alternatives assumed a non-declining flow in timber volume outputs.
- All alternatives assume a doubling in acres burned by wildfire per decade relative to the period from 1986-2015. See appendix B for further information on the scientific basis for this assumption. Notably, a doubling of acres burned relative to this thirty year time period represents only a modest increase from acres burned in the most recent decade for which data was available (2006-2016).

Using the vegetation treatment schedule developed by PRISM, simulation of vegetation change was then projected across five decades into the future, using the SIMPPLLE model. Fifty years is considered a reasonable time period over which to model potential disturbances and succession, and to capture trends in vegetation condition, considering that some drivers of change occur very quickly (such as fire), while others are much more gradual (such as growth and succession). There is an increasing level of uncertainty associated with ecological and social change beyond five decades, especially as related to climate change. Twenty model simulations were run to better capture the variability and uncertainties associated with disturbance events and resulting vegetation change. Therefore, model results for each alternative provide not a single value but a range of values for vegetation condition across the 50-year projection.

Information Sources

This analysis draws upon the best available science found to be relevant to the ecosystems on the Custer Gallatin National Forest. Literature sources that were the most recent, peer-reviewed, and ideally local in scope or at least directly applicable to the local ecosystem were selected and cited throughout. Uncertainty and conflicting literature was acknowledged and interpreted when applicable.

Region 1 Existing Vegetation Database (VMap): Mapping of current vegetation is based on the USDA Forest Service Region 1 vegetation database. VMap is a geospatial dataset developed using the Region 1 existing vegetation classification system (Barber et al. 2011). It is a remotely sensed product that is derived from satellite imagery, airborne acquired imagery, field sampling and verification. Detailed metadata for this database can be found in the project file. The VMap data used for this analysis was updated in 2015. Accuracy of the VMap data varies between 74 and 90 percent depending on the particular attribute (Brown 2016).

Riparian vegetation classifications in the original VMap do not include hydrological features; therefore, more refined riparian and wetland area data sources were incorporated using National Wetland Inventory data provided by the Montana State Natural Heritage Program which also covered the South Dakota portion of the Sioux District. The National Wetland Inventory maps riparian and wetland areas based on aerial imagery, hydrological feature mapping, soils, and vegetation layers.

For the montane units, the National Wetland Inventory map and the Montana State Natural Heritage Program data and riparian extent model were used for inclusion into VMap. Riparian extent was modeled using a tool developed by Forest Service Washington Office personnel for the montane units. The model made use of a lakes/ponds feature class, digital elevation models, 6th hydrologic unit code watershed boundaries, and NetMap streams data. Parameters are applicable to hydrologic considerations of the montane units as opposed to the Pine Savanna units. While the model will also accept hydric soils and hydrologic soil group information, the lack of these available data precluded their use in the mapping effort. Locations within the modeled riparian area that did not intersect with the Montana State Natural Heritage Program riparian polygons were attributed with Region 1 existing vegetation data via intersection. Where upland vegetation was mapped within the riparian corridor, a local classification was assigned denoting that while the location was not classified as containing riparian vegetation, it fell within the riparian corridor (Reid et al. 2018).

For the pine savanna units, National Wetland Inventory map data and refined green ash woodland data (Biswas et al. 2012) were used for inclusion into VMap. Flow regimes and stream orders were used to differentiate between non-riparian green ash woodlands and riparian-green ash woodlands. The riparian extent model used for the montane units was not used for the pine savanna units due to limited application of model parameters.

Forest Inventory and Analysis (FIA) and the Region 1 Summary Database: This analysis draws upon measurements collected on spatially balanced forest inventory and analysis grid plots. The forest inventory and analysis grid is a nationwide grid which includes 517 plots on the Custer Gallatin National Forest. This dataset is used to display estimates for the Forest because it spatially represents all National Forest System lands. Forest inventory and analysis plot data is summarized in the Region 1 summary database, which includes statistical reporting functions and derived attributes (Bush 2015, Bush and Reyes 2015, Bush et al. 2016). In 2015 Region 1, in collaboration with the Remote Sensing Application Center and Interior West- forest inventory and analysis developed a set of protocols to re-measure forest inventory and analysis plots after they were burned by recent wildfires, this was done for the Custer Gallatin National Forest plots and used for this analysis.

Aerial Detection Survey (ADS): Survey data and condition reports that estimate levels of tree mortality and defoliation resulting from insects and diseases (http://www.fs.usda.gov/detail/r1/forest-grasslandhealth/?cid=stelprdb5366459).

Forest Activity Tracking System (FACTS): The forest activity tracking system is the current activity tracking database in which all management and natural events are recorded. Information from this database is used to quantify the extent and type of management actions that have occurred. Currently, both spatial and tabular information is required when activities occur on National Forest System lands. The geographic information tool was used to create the maps of past harvest, fire, and fuels. The forest activity tracking system database is the newest of several activity tracking databases developed over the years and used by the Forest Service in Region 1; older records from previous systems such as the Timber Stand Management Record System are incorporated into forest activity tracking system. The earliest activity records date back generally to the 1940s or 1950s, when activity tracking protocols were adopted. Older records are likely not as accurate due to improvements in modern record keeping. Site-specific records of early harvest activities during the initial settlement of the area are not available but are addressed qualitatively using other information sources such as boundary report notes compiled when the National Forest Reserves were first proposed.

Analysis Area

The affected area for effects to terrestrial vegetation is the lands administered by the Forest. This area represents the National Forest System lands where changes may occur to vegetation because of management activities or natural events.

The affected area for cumulative effects to terrestrial vegetation includes the lands administered by the Forest, as well as the lands of other ownership, both within and immediately adjacent to the Forest boundaries.

The temporal scope of the analysis is the anticipated life of the plan with some analysis occurring across the longer term (50 years), consistent with the analysis period for key ecosystem characteristics associated with the terrestrial vegetation.

3.6.2 Affected Environment (Existing Condition)

This section describes the primary ecosystem characteristics that affect vegetation, ecological integrity and resilience. An ecosystem is defined as a spatially explicit, relatively homogeneous unit of the earth that includes all interacting organisms and elements of the abiotic environment within its boundaries (Forest Service Handbook 1909.12). Ecosystem integrity is the condition where natural ecological composition, structure, and processes are essentially intact and self-sustaining. The ecosystem is able to evolve naturally with its capacity for self-renewal and biodiversity maintained. As such, resilience is a fundamental characteristic of ecological integrity. Ecosystems are described in terms of structure, composition, function, and connectivity (Code of Federal Regulations 219.8). Composition refers to the types and variety of living things. Structure is the physical distribution and character of components of the ecosystem. Function is the processes or interactions that occur among the elements of the ecosystem; connectivity is the spatial linkage among them.

Additional information about the affected environment can be found in the forest plan assessment and associated vegetation specialist reports (Reid 2017a;b, Sandbak 2017, Thornburgh 2017).

Ecosystem Function

The terrestrial vegetation is constantly changing across space and time as a function of ecological processes and disturbances. The primary causes of vegetation change that are integrated into this analysis are vegetation succession, fire (wild and prescribed), forest insects and diseases, and timber harvest. Climate change is also expected to interact with these processes and have a significant impact on ecosystem function as discussed above and within specific topic areas within this section. Complex interactions between these ecosystem processes, climate and vegetation has resulted in the vegetation composition and structure that currently exists, and will continue to drive changes to vegetation into the future as evaluated in this environmental impact statement. Each is briefly discussed below.

Fire (Wildfire and Prescribed)

Fire is a primary ecological process that has created, maintained, and renewed vegetation on the Custer Gallatin National Forest. Fire fulfills many ecological functions, including carbon and nutrient recycling, snag and tree cavity creation, stimulating seeding and sprouting of vegetation, and increasing biodiversity. Natural fire regimes include low, mixed, and high severity fires. The natural range of variation analysis showed that sites in the Warm Dry broad potential vegetation group tended to burn with mixed or low severity, while the Cool Moist group tended to burn with stand replacing severity. All fire types were well represented in the Cold broad potential vegetation group. Table 33 briefly describes the effects of fire on the vegetation of the Custer Gallatin National Forest based on fire regimes (National Interagency Fuels 2010).

Climate strongly influences fire regimes. Historically, extended periods of warm and/or dry conditions tended to be associated with larger, higher severity, and more widespread fires. Shade intolerant, fire resistant species may still have developed into mid and late successional stages where low severity regimes were maintained; as did shade tolerant species in areas spared from fire. Periods of cool and/or moist climatic conditions tended to be associated with smaller and less severe fires. Long time intervals (such as, 100 years or more) between major fire events were common during such periods, which allowed more shade intolerant forests to develop into the mid and later stages of succession. Fire sets back natural succession at least temporarily, and generally starts vegetation succession over again at an earlier seral stage than what it was prior to the fire.

Wildfire will often be a greater disturbance (more often move succession to an early seral stage) than wildland fire because planned fires are designed through the burning plan to use certain wind, temperature, and moisture conditions at the time of ignition and duration of burning to achieve specified vegetative and fuel conditions. Wildland fire treatments are used to meet a variety of vegetation-related resource objectives, including improving wildlife habitat, stimulating shrub sprouting, reducing stand densities, reducing forest fuels (downed wood), creating early-successional habitat openings, and restoring natural disturbance processes.

Table 33. Fire severity effects on vegetation of the Custer Gallatin National Forest (adapted from National Interagency Fuels (2010))

Fire Regime	Severity, Frequency, and Vegetation Type	Fire Effects on Vegetation of the Custer Gallatin National Forest
I	Low severity, 0-35 years. Ponderosa pine, dry-site Douglas-fir and deciduous woodland draws	Open forest, woodland, shrub and savanna structures are maintained by frequent non-lethal fire. This regime also includes mixed severity fire that creates a mosaic of age classes. Low severity fires result in minimal overstory mortality (less than 25 percent of dominant overstory) and small patch size. The forests in this regime were often dominated by ponderosa pine or Douglas-fir; fire maintained these species and promoted open, often uneven-aged, structures. These species reforest gaps created by fire through the survival of fire-resistant seed bearing trees. These fires also maintained open, dry forest savannas and a shifting distribution of dry limber pine/juniper ecotone communities.
II	Stand-replacing, 0-35 years. Grasslands, mixed grass pine savannas, mountain big sagebrush, and Great Plains shrublands	Shrub or grasslands are maintained or cycled by frequent fire; fire typically removes nonsprouting shrubs, tops of sprouting shrubs and most tree regeneration. These fires are important in vegetation communities such as mountain big sagebrush.
III	Nonlethal and mixed severity, 35-100+ years. Wyoming big sagebrush, low sagebrush, riparian systems (cottonwood), limber pine / Rocky Mountain juniper, dry lodgepole pine and moist Douglas-fir	A mosaic of ages, early to mid-seral forest stages, and shrub and herb dominated patches is maintained by infrequent fire. Mixed severity fires kill a moderate amount of the overstory, burning with a mosaic of severities but replacing less than 75 percent of the overstory. Highly variable patch sizes are created, with an irregular pattern with an abundant amount of edge. Fire tolerant species often survived fire, with large, old trees becoming prominent overstory components. These fires also resulted in unburned patches that could develop climax conditions dominated by shade tolerant species.
IV	Stand-replacing, high severity, 35-100+ years. Moist lodgepole pine, subalpine fir, Engelmann spruce and aspen	Large patches of similar aged forests are cycled by infrequent fire. Stand replacing fires kill most trees (over 75 percent) over a large area. Lodgepole pine regenerates large areas by storing serotinous cones that open under intense heat. Mature lodgepole pine stands on the Custer Gallatin National Forest generally exhibit a high degree of serotiny. Fire return intervals are generally long; however, shorter intervals also occur and forests may re-burn after dead trees have fallen. Lodgepole pine produces open cones at a young age to re-seed re-burned or understocked patches. Serotiny in fire-prone ecosystems is typically expressed from 30-60 years of age to ensure that seed is available after the next stand-replacing event.
V	Any severity, 200+ years. Boreal forest, high elevation conifer forest, whitebark pine and subalpine forbs and grasses	Variable size patches of shrub and herb dominated structures, or early to mid to late seral forest occur depending on the biophysical environment and are cycled by rare fire events. These forests often have complex structures influenced by small gap disturbances and understory regeneration. Fires may result in the regeneration of lodgepole pine but also provide suitable sites for the establishment of whitebark pine at the highest elevations. Many sites become dominated by subalpine fir at the later stages of succession.

Fire also maintains the diversity of vegetation across grasslands, retards or prevents conifer encroachment in meadows and parks, regenerates aspen stands, and is responsible for maintaining the mixture of vegetation necessary on shrublands for wildlife habitat diversity for such species as elk, deer, antelope, sage grouse, and many non-game species.

For much of the last century, wildfire burned less area than it should have relative to the historic condition. This was due to fire exclusion, forest and grazing management, and climate (Hessburg and Agee 2003, Hessburg et al. 2005, Westerling et al. 2006). Roads, railroads, grazing, urbanization, agriculture, and rural settlement all influenced fire exclusion (Hessburg et al. 2005). Since 1940 most geographic areas on the Custer Gallatin National Forest had a fraction of their area burn in any given decade. The consequences of this departure included:

- Fire in many dry forests, especially in Ashland and Sioux Geographic Areas, shifted from low-severity, high frequency to less frequent, moderate and high-severity, with increases in uncharacteristic large-scale stand-replacing fires (Lehmkuhl et al. 2007). Fires of higher severity can kill fire-resistant seed bearing trees, disrupting the ability of these forests to regenerate.
- Higher elevation moist forests of the montane ecosystems, which are often dominated by lodgepole pine and subalpine fir, naturally have a long fire interval with higher severity fires (Fischer and Clayton 1983, Arno et al. 2000). Changes to the natural regime are less pronounced than in frequent interval fire regimes. However, at the landscape scale, fire suppression in lodgepole pine may induce mosaic homogeneity in forests that previously contained a heterogeneous mix of age classes (U.S. Department of Agriculture 1990, Barrett 1993). In these areas fire suppression had the effect of decreasing acreage burned in normal fire seasons and reducing the variability in landscape patterns.
- Mixed-severity fire regimes experienced changes described for both low- and high-severity regimes. Fire exclusion reduced stand and landscape diversity in subalpine forests so that vegetation aged more uniformly and became less diverse, resulting in stand replacing fires that regenerate extensive areas that were mosaics historically (Barrett et al. 1997).
- Fire regimes in non-forested areas changed in large part due to conifer encroachment that has resulted from fire exclusion, grazing, and climate (Heyerdahl et al. 2006). In areas that historically had a mosaic of grasslands and shrubland with islands or scattered individual conifers, the tree cover has increased exponentially. This is especially prevalent in the Pine Savanna and dry site Douglas-fir/grassland habitats and is largely due to the lack of frequent fire that would have killed conifer seedlings. Climate conditions prior to the 1980s would also have been conducive to the growth of conifers occupying grassland habitats.

On the Custer Gallatin National Forest, increasingly large fires have been occurring since 1980. The increase may be due to: 1) fuel buildup in low-severity regimes; 2) the influence of a warm/dry climate on vegetation, fire behavior, and effectiveness of suppression; and 3) fire policies that have allowed natural fires to burn in some areas. The increase in acres burned is consistent with the regional climate shift (Marlon et al. 2012), and a trend of acres burned occurring throughout the West.

Fire suppression will likely continue to alter successional processes, generally to favor shade-tolerant species, although vegetation treatments and wildfires may mitigate this influence somewhat. Warmer, drier climates will influence species distributions and successional processes in complex and uncertain ways. For example, species better adapted to warm, dry conditions such as ponderosa pine may gain a competitive advantage in some areas. Vegetation composition influences, and is in turn influenced by, spatial heterogeneity of landscapes and interrelated ecosystem drivers.

Recent large fires have changed the amount and pattern of forest cover across much of the Ashland and Sioux Geographic Areas and a smaller proportions across the other districts. Even though many areas of forested cover types burned in recent fires, there is only a minor component of that that is considered as transitory rangeland. Transitory rangelands will shift to more grass and forb species and will eventually shift back to shrubs and tree cover over time. This shift back to tree cover is estimated to take about 20 to 80 years plus, depending on the seed source that remains post-fire. North, northeast, and east aspects will likely sprout mesic shrubs with very little grass forage. West, southwest and south aspects will likely express a grass/forb cover longer.

The effects of warmer climate may have been more than counteracted by fire suppression activities in the last century, with the net result being an increase in the frequency of succession from grasslands to shrubland, especially shrublands dominated by mountain big sagebrush.

Both fire regime and impacts of fire are assessed as part of watershed condition framework (USDA 2011). Only 56 (29 percent of) montane and 22 (27 percent of) pine savanna watersheds are within their natural fire regime or within fully functioning condition, if recently burned. One watershed across the Custer Gallatin National Forest was rated as impaired function, with the vast majority (194) of Custer Gallatin watersheds rate as functioning at risk with respect to fire regime.

Overall, fire suppression has resulted in an increase in conifer colonization into grassland, shrublands, and broadleaf woodlands such as green ash and aspen. Without periodic disturbance, these cover types may be replaced by conifers. Mountain and Wyoming big sagebrush are sensitive to colonization by conifers; studies have shown that in southwestern Montana, mountain big sagebrush is declining due to competition from Douglas-fir and Wyoming big sagebrush is declining due to competition from ponderosa pine. Douglas-fir and ponderosa pine expansion into grass and shrub communities may in part reflect natural ecotone dynamics, but past overgrazing, climate changes, and fire exclusion have likely caused more extensive colonization than would be present naturally. In the absence of natural fire both Rocky Mountain and Utah juniper is likely more widespread and abundant than it would have been historically in moister sites. Rocky Mountain and Utah juniper expansion can lead to the decline of grass and shrublands and result in altered fire regimes. On xeric sites, fire may never have been as important an influence as climatic fluctuations in governing the rate of tree invasion of shrubland or grassland because of the lack of undergrowth to act as fuel. Moister, more productive sites probably had more extensive and frequent fires when droughty periods occurred (Bradley et al. 1992).

There is potential that wildfire may play a larger role in shaping vegetation in some areas, perhaps promoting non-forested vegetation communities, particularly given warmer climate regimes. Warmer temperatures will likely result in increased fire size and severity, creating more favorable conditions for invasive species, which would likely decrease overall forage quality and biodiversity. Grasses generally recover well following low to moderate severity fires. Some grasses, such as Idaho fescue, may decline following high severity fires. The outcome after a fire varies depending on species present before the fire. Fire combined with prolonged drought periods can shift the species composition and increase invasive weeds.

Insects and Disease

Grassland and shrubland ecosystems worldwide are prone to infrequent and periodic outbreaks of native insect herbivores and are a natural part of these ecosystems. Grasshoppers and Mormon crickets are the most common types which contribute significantly to the structure and function of grasslands and other rangelands (Branson et al. 2006). These outbreaks occur periodically on the Custer Gallatin National Forest. The outbreaks can be anywhere from unnoticeable to exceeding 200 insects per square yard. The outbreaks tend to be more prevalent during periods of drought. Grasshopper outbreaks can have severe economic impacts on the grazing industry, especially during periods of drought when available forage is already scarce (Hewitt and Onsager 1983). In general, since most insect infestations are short-lived (a year or maybe two in the same area), the effects on rangeland vegetation are a defoliation (partial or complete) of the current year's plant growth, but vegetative community succession is seldom affected.

Climate, especially drought, is thought to play a key role in outbreaks of grasshoppers and other insect species on rangelands, but the underlying mechanisms are poorly understood (White 1976, Gage and Mukerji 1977, Capinera and Horton 1989, Kemp and Cigliano 1994). Drought can have both direct effects on the growth and survival of insects and also indirect effects via changes in food quality and susceptibility to disease.

Non-severe drought and warm temperatures generally have a positive effect on grasshopper populations. Warm, dry weather in winter and early spring can lead to increased survival, early egg hatch, and faster population growth; warm, dry weather in the fall can extend the life of females and allow them to produce and lay more eggs (Joern and Gaines 1990). Moreover, grasshoppers often prefer to feed on drought-stressed plants, partly due to drought-induced changes in plant chemistry (Haglund 1980, Lewis 1982, Bernays and Lewis 1986). Drought could further promote grasshopper populations by reducing incidence of disease, especially due to fungi as many fungi require moisture (Hajek and St Leger 1994, Finch et al. 2016). However, extreme or prolonged drought can negatively affect grasshoppers through desiccation (especially eggs) or by killing their food plants (Farrow 1979, Joern and Gaines 1990). Therefore, short-term, less severe droughts can increase grasshopper outbreaks, but longer-term, severe droughts will likely have a strong negative effect on grasshoppers and rangeland and grassland biodiversity in general (Tilman and El Haddi 1992, Kemp and Cigliano 1994).

Grasshoppers and Mormon crickets are always present in any given year, but populations change in terms of relative abundance on the landscape. Outbreaks have been known to occur. There has not been any recent insecticide use by the Animal and Plant Health Inspection Service to control and reduce grasshopper or Mormon cricket populations on the Custer Gallatin National Forest, although periodically there have been proposals in and near the Ashland Ranger District.

In the forested ecosystems of the Custer Gallatin National Forest, insects and diseases are important ecosystem drivers as they can influence vegetation on a local and landscape level. There are many insects and diseases that affect the forested vegetation on the Custer Gallatin National Forest. Most of these are native and exist at relatively low population or intensity levels that do not cause notable impacts or have limited localized effects. Insects and diseases can reduce tree growth or result in mortality of specific species or size classes. A few, such as bark beetles can have a more substantial effect as small groups of trees or entire hillsides can be killed in one year. Over time these agents can change forest compositions and structure. The report on the assessment of terrestrial vegetation (Sandbak 2017) provides a detailed description of current conditions for key insects and diseases found on the Custer Gallatin National Forest. Maps A1.5 to A1.9 in the appendix of the terrestrial vegetation report (located in the project record) display cumulative infestations for insects of concern from 2000 to 2015 by geographic area.

With the exception of white pine blister rust and balsam woolly adelgid, the insects and pathogens on the Custer Gallatin National Forest are native and have co-evolved with their hosts over millennia. Through selective killing or reducing growth of trees, they influence structure and composition which affects other processes such as fire. They benefit plants and animals that utilize dead or modified wood, or feed on insects or pathogens. These agents have a role in maintaining soil fertility. Climate and weather play a major role in controlling insects, as does availability and quality of food and breeding habitat. Historically, insect populations would periodically build to high levels under favorable climatic and host conditions. Frequency of epidemics varies by species and locality. Cool climate conditions, such as those that predominated from the 1940s through the 1970s, were not conducive to outbreaks. The current warm/dry cycle correlates with the increased extent of outbreaks since the 1980s. Human actions such as fire suppression, past logging practices, and land development in conjunction with succession influence vegetation, which influences the population or intensity of insects and diseases. Higher stand densities increase stress and competition for resources, which renders trees less able to resist insect and diseases.

Invasive Species

Establishment and spread by aggressive non-native invasive plants is one of the greatest threats to the ecosystems in Custer Gallatin National Forest. Aggressive non-native invasive plants have the potential to alter ecosystems by outcompeting and displacing native plants. Invasive plants have been found to impact wildlife habitat by decreasing the amount of forage, change fire frequency by forming dense stands of flashy fuels, and change soil characteristics by altering soil nutrients. Presence and abundance of invasive plants are a key indicator of condition in grasslands, shrublands, open canopied woodlands and riparian existing cover types (under 9000 feet elevation and less than 65 percent tree canopy cover) which covers about 1.8 million acres, or 53 percent of the Custer Gallatin. These ecosystems are vulnerable to aggressive invasive plant establishment and spread. There is now a footprint of about 58,000 acres of weeds and weed seed banks on the Custer Gallatin. Available resources have only allowed weed treatment annually on about 4,000 to 5,000 acres.

Warmer/drier climate trends are predicted to accelerate the pace of spread by invasive plant species. Anticipated higher fire occurrence and resulting fire effects is also likely to accelerate the pace of spread by invasive plant species. With projected increasing average annual temperatures over the coming decades coupled with continued and/or increasing drought will likely further invasive weed spread along with increase in abundance and density. As springtime temperatures increase, the extent and magnitude of cheatgrass infestations may increase. Continued weed treatment emphasis along spread vectors (predominantly along travel routes) and in rare or special habitats is needed (that is, big game winter ranges, greater sage-grouse habitat, research natural areas, special interest areas, wilderness study areas, wilderness areas). Invasive plants have not been a serious problem in the alpine settings of the Custer Gallatin National Forest, although a minor amount of yellow toadflax and Canada thistle are present above 9,000 feet and has the potential to invade such areas in the future.

The emerald ash borer, a beetle native to Asia, was first found in North America in 2002 in southeastern Michigan. Across the United States, emerald ash borer has killed tens of millions of ash trees and poses a serious threat to the green ash resources. The broad distribution of emerald ash borer is largely due to the inadvertent movement of infested ash commodities, especially before its original detection. Emerald ash borer was recently detected in eastern South Dakota and northern Colorado, and could pose serious threat to the health of green ash resources on the Sioux and Ashland Districts if transported to the area. In its native range emerald ash borer does not cause serious damage to ash trees, however, due to lack of host resistance by North American ash trees as well as lack of predators and parasitoids, emerald ash borer has had a significant impact on the ecology and economy of infested areas.

Succession

Vegetative succession is the sequential process of long-term plant community development. It entails the change in the composition and structure of plant communities over time, and is based, in part, on the particular set of environmental conditions under which it will reproduce and grow. Over time ecological succession can result in the conversion of one vegetation type to another.

The successional process follows a pathway with each major step referred to as a seral or successional stage. In a simplified model for a coniferous forest, early successional stages follow a stand-replacing disturbance. Plants immediately start colonizing the site; this is known as the establishment phase. Then follows a series of intermediate successional stages, referred to as mid- and late-successional stages, where established species grow larger and denser based on site capability. During these stages, new plants may be inhibited by high site occupancy or initiated in gaps as competition-based mortality occurs. Changes in environmental conditions and competition for resources cause some species to decline and others to expand. The classical model of succession culminates in the climax community, a state of relative stability in composition, structure and function, with all existing species able to perpetuate themselves without disturbance.

Plant species are often distinguished as playing either an early- or late-successional role. Species with traits that enable rapid colonization of a site after a disturbance are early successional. They are less shade tolerant, able to flourish under full or nearly full sunlight, and have rapid early height growth. Ponderosa pine, lodgepole pine, aspen, and whitebark pine are early successional tree species on the Custer Gallatin National Forest. In non-forested communities, early seral plants include grasses or forbs that re-sprout quickly. Late successional, or climax, species are typically shade tolerant, capable of reproducing and growing in shady conditions. Douglas-fir, Engelmann spruce, and subalpine fir are climax tree species on the Custer Gallatin National Forest. Late seral non-forested species include woody shrubs that re-seed more slowly, such as sagebrush. Species can play multiple successional roles depending on site conditions and species associations.

In disturbance-prone ecosystems (such as the Warm Dry potential vegetation type) the climax state may rarely be achieved because succession is interrupted by disturbances such as wildfire. Therefore, long-lived, fire tolerant early successional species are influential. They may survive wildfires to grow large and become prominent features of the overstory canopy, providing structural components of late successional forest.

Successional pathways are complex and the rate of change can be variable; simplification of the process is necessary for analysis. The evaluation of forest size classes provides a proxy to evaluate successional change of forests over time. The early successional stage is characterized by the seedling/sapling size class. As trees grow, they transition from smaller size classes into larger size classes. Mid-successional forests are associated primarily with the small and medium forest size classes, but in some cases forests in the large size class are also mid-successional, depending on tree ages and species. Late-successional forests are associated mainly with the large forest size class.

About 65 percent of the Custer Gallatin National Forest lies within some type of designated area including wilderness, inventoried roadless areas, research natural areas, or wilderness study area. Special area designations tend to reduce the amount of human-caused disturbances, so generally succession of vegetation tends to proceed toward late seral conditions in these areas (barring setbacks from natural disturbance). Wilderness areas, wilderness study areas, and research natural areas are generally managed to promote "natural" succession and disturbances.

Harvest

Timber harvest is defined as the removal of trees for wood fiber use and other multiple-use purposes (FSM 1909.12_zero_code and 36 CFR 219.19). Harvested trees are typically but not always utilized commercially. Harvest activities are utilized to meet multiple resource objectives as allowed for in forest plans, which include providing for jobs and wood products to communities; improving forest health, vigor, and productivity; and providing for vegetation diversity. More recently this tool is used to assist in restoration of ecosystem processes, improve resilience, promote certain wildlife habitats, and/or to reduce or alter fuels to modify or change fire behavior. The following is summary of timber harvest on the Custer Gallatin National Forest since 1940 based on the FACTS database. See Thornburgh (2017) for a more detailed description of the affected environment related to historic timber harvest including acres of harvest by harvest type within each geographic area. The Timber section in Volume 2 further discusses the affected environment relative to timber harvest.

Timber harvest consists of three general types. Table 34 provides a summary of how treatments generally affect vegetation.

Table 34. Description of harvest types and effects

Treatment	Description
Even-aged regeneration harvest	Even-aged regeneration harvest includes clearcuts, seedtree, and shelterwood cuts with or without reserves. These cuts remove the majority of overstory trees and allow new seedlings to establish. The size class changes to seedling/sapling, in either a single or two-storied structure, initially with low canopy cover. Cover type and species presence may change. Woody material (for example, downed wood, snags) may change, often but not always reduced. Natural regeneration and/or tree planting occurs, which influence species composition and forest density. Later, non-commercial thinning may occur in sapling stands, reducing densities and affecting species compositions and structure over the long-term.
Uneven-aged regeneration harvest	Single or group selection are types of uneven-aged silvicultural systems, which establish a new seedling/sapling size class and may change species composition. Unlike even-aged regeneration harvest, the conversion of the existing stand occurs gradually over many decades, creating a multi-age and multi-size stand. Small openings are created with each entry while the remainder of the existing overstory. For example, a stand could have a treatment every 20 years, creating openings on 20 percent of the stand each time, resulting in the entire stand being treated over 100 years. Reforestation and stand tending may occur to affect species composition and structure. Reduction of downed wood and/or snags may occur.
Intermediate harvest	Intermediate harvests enhance growth, quality, vigor, and/or composition of an existing stand, and do not cause a shift to a seedling/sapling condition. Treatments in this category include commercial thinning, liberation harvest, sanitation/salvage, and improvement cutting. These treatments leave a forest that is still dominated by trees larger than saplings. The focus is not on regenerating a new forest, but in changing the condition of the current one. Not only is forest density reduced, but species compositions and forest size class may change. Tree growth is typically accelerated. Reduction of downed wood and/or snags may occur.

Harvest activities occurred on about 155,503 acres on the Custer Gallatin National Forest since about 1940 according to FACTS. This represents about 7 percent of the non-wilderness land base. Of total harvested acres, 97,329 acres were regeneration, 44,679 acres intermediate, and 13,495 acres uneven-aged.

In the Montane ecosystems, timber harvest peaked in the 1960s around 33,700 acres. For the 1970s and 1980s, harvest varied from 23,000 to 30,000 acres with the highest in the 1980s. The 2000 to 2009 levels dropped significantly to 3,100 acres, with most occurring as intermediate harvest (salvage, commercial thinning). This decline was likely due to litigation, decreased budgets, and less emphasis on the use of timber harvest as a tool for management of the resource. Because of this, forest managers tended to plan smaller harvest acreage and treatment units over the last 15 years. There has been a steady decline in harvest acres since 1980, however in the last five years there has been a slight increase over the previous decade. Regeneration harvest treatments were dominant through the 1990s and in the last five years no regeneration harvest occurred. Intermediate treatments became more widely used in the 1980s and the last five years are 94 percent of the harvest acres. Uneven-aged treatments peaked in the 1970s and have since been used less.

In the pine savanna, timber harvest peaked in the 1980s at about 7,500 acres. In the early 1990s after the large fires in 1988, managers begin recognizing that without fire or management the existing stand structures that had developed over the last 80 years in these dry forest types were not sustainable nor resilient to large disturbance events such as fire. This was particularly evident in the 58,300 acre, 1988 Brewer fire on the Sioux Ranger District. Seventy one percent of the forested area experienced a high mortality stand replacement fire event significantly reducing forest cover. Beginning in the early 1990s there was an emphasis on creating fuel breaks until further treatments could be planned and implemented. The 1990s harvest acres were largely the result of this effort. In the 2000s, an effort began to treat larger landscapes using timber harvest to help meet objectives and desired conditions. In 2012, one of these planned efforts that had a sale nearly sold, burned up in the Ash Fire on the Ashland District. Since 1980, there has been a downward trend in harvested acres, with a small increase in the 1990s. From 2010 to 2015 timber harvest as a tool has been emphasized less by forest management with declining budgets and the result has been a large downward trend with only 657 acres harvested between 2010 and 2015. Regeneration harvests peaked from 1990 to 2009, with about 2,500 acres in each decade. Intermediate treatments have been the dominated treatment since 1950, occurring on about 57 percent of the total treatment acres. Uneven-aged management, largely individual tree selection harvest occurred on 18 percent. Ninety nine percent of timber harvest from 2010 to 2015 has been intermediate harvest.

Pollinators

Plants such as flowering shrubs, legumes, forbs, and wildflowers provide consistent foraging habitat during the spring, summer, and fall. Pollen (usually moistened with nectar or floral oil) is used to feed larvae, and nectar is used to fuel the flight of adults. Many pollinators are active above ground as adults for only a few weeks or months. Pollinators require a reliable protein source (nectar and/or pollen) during their active period (generally late April through early October) to carry the adult and offspring through the winter to the next blooming period. Relatively undisturbed conditions with suitable ground and/or nest structure provide nesting sites. Nest sites are important because the further the pollinator must travel the more nutrients the pollinator uses. If the pollinator travels long distances to a “poor” food source, and if the pollinator is stressed, then the pollinator may be more susceptible to environmental factors such as parasites and disease resulting in possible starvation or possible reproductive decline. The average foraging distance for native pollinators ranges from approximately 50 feet to ½ mile. The optimal foraging distance for nonnative pollinators, such as the European Honey Bee, is approximately three-quarters of a mile to one mile from the colony (U.S. Department of Agriculture 2008).

There is concern that pollinators may be declining at a global scale. Though there are knowledge gaps about the status of most of North America's pollinators, what data does exist suggests that numerous species of invertebrate pollinators are experiencing declines similar to or more severe than the declines seen in honey bees and these declines can impact crop yields and native plant communities (Kevan 1977, Watanabe 1994, Allen-Wardell et al. 1998, Kearns et al. 1998, National Academies Press 2007, Colla and Packer 2008, U.S. Department of Agriculture 2015a). Honey bee populations have experienced steep declines, but there is less information on native bee species. It might be expected that the regional bee fauna as a whole may also show signs of long-term decline, though it could also be possible that despite changes on the landscape, bee species are able to persist in similar levels of diversity (Marlin and LaBerge 2001). One-quarter of North America's bumble bees have experienced significant declines (Hatfield et al. 2015), including declines in species that were formerly some of the most common species (Evans et al. 2008, Grixti et al. 2009, Cameron et al. 2011). Though there is limited data available about all pollinator species known to occur on the Custer Gallatin, the species present may face similar threats and declines.

Pollinators encompass a broad range of habitat requirements on the Custer Gallatin and National Forest System lands have the potential to provide resources needed for all life stages (such as, host plants, nectar plants, and overwintering habitat for butterflies). The general conditions that support pollinators on a landscape are pollinator food sources, shelter and nest sites, habitat heterogeneity, and landscape connectivity. Native plant species and plant community composition requirements vary for different groups. Insect biology influences species needs and ecological roles on the landscape.

The different sizes of bees allow for differences in distance traveled for forage, life cycles and habitat conditions. Strong fliers, such as bumblebees and honeybees, often forage great distances from their hives in order to exploit the most rewarding floral patches. By contrast, weak-flying pollinators, such as solitary wild bees and some butterflies, may have limited ranges and forage for resources only near the nest or roosting site. Species also have specific times for flower visits, such as early or late morning, which is influenced by light intensity (Shelly et al. 1993). Therefore, a habitat fragment may entirely support a population of small bees, support part of a population of mid-sized bees, or act as a single island of resources for large-bodied bees. Taken together, nesting substrate, diet breadth, and foraging range strongly characterize the habitat requirements bee species have and may predict their response to habitat fragmentation (Cane et al. 2006, Gilgert and Vaughan 2011).

Flowering plants are important sources of nectar and pollen for pollinators. A diversity of flowers with a succession of bloom throughout the growing season across different habitat types benefit wild pollinators such as solitary bees and monarch butterflies, as well as managed honey bees, which benefit from a diversity of pollen sources to maintain a healthy immune system (Smallidge and Leopold 1997, Hoffman Black et al. 2011). The availability of floral resources influences the abundance and diversity of butterflies and bees in studies of roadside habitats and grasslands. Bees have floral guilds – a specific group or type of flower resource they use for forage; some pollinator species have very specific habitat requirements that differ between sexes and life stages and could depend entirely on a single plant species, while other species have much more generalized habitat requirements. Pollinators that specialize are more likely to be at risk than generalist pollinators (Allen-Wardell et al. 1998, Cane 2011). Others are much more liberal in their tastes, but in either case, managing for diverse plant communities for native bees will greatly assist in increasing the abundance of butterflies and moths. (Gilgert and Vaughan 2011). A lack of forage is frequently cited as a primary contributing factor to declines in honeybee health (National Academies Press 2007). Maintaining diverse and healthy grasslands ecosystems in various seral stages benefits pollinator species. Especially for ground-nesting bees, it seems that carrying capacity in a given habitat is constrained by limited pollen and nectar resources rather than inadequate nesting opportunities (Roulston and Goodell 2011).

Invertebrate pollinators also require shelter sites for nesting or egg-laying, or overwintering habitat. Most species nest underground or nest aboveground in old beetle tunnels in deadwood or pithy or hollow dead twigs or stems. Bees provide for their young by constructing nests in which their offspring develop. Many ground-nesting bees prefer to nest in sunny, bare patches of soil. Such patches can be found around the bases of native bunch grasses that tend to grow in dense bundles, leaving small areas of bare ground exposed between plants. Ground-nesting bees can be more common in roadsides with native plantings in contrast to areas with a tight sod of brome or other nonnative cool season grasses. Vegetation also provides habitat for tunnel-nesting bees, which nest in hollow or pithy stems or other small cavities. Bumble bees require a small, insulated cavity, such as underneath grass clumps or under the thatch of bunch grasses (Hatfield et al. 2012). The breeding and overwintering habitat needs are less understood for other groups of pollinators, but syrphid fly species and soldier beetles have been recorded as overwintering in soil or litter (Schaffers et al. 2011). Butterflies and moths may also utilize similar areas as overwintering habitat or shelter.

Habitat heterogeneity is critical on the landscape to maintain populations of pollinators. The resources needed by many insect pollinators, including mates, nectar and pollen, nesting materials and larval food plants, may occur in different habitats in the landscape. For example, different pollinator guilds (bumblebees, honeybees and large wild bees) prefer patches of different qualities in the mosaic of habitats in an agricultural landscape (Artz and Waddington 2006). Butterfly habitats commonly deteriorate through a reduced intensity and frequency of long-term disturbance regimes or management patterns that result in smaller and fragmented patches of early successional habitat. Many butterflies are more abundant in open sunny woodlands over shady woodlands (Smallidge and Leopold 1997), making them at risk of declining in areas of conifer encroachment and fire suppression. Bumblebees have been documented to have higher fitness in areas that have a meadow complex that provides a variety of habitats over isolated meadows that have a burst of floral resources that quickly disappear as the flowering season progresses. Bumblebee mobility and the varied habitats (such as, difference in wetness, flowering phenology) increases the probability that floral resources would be available throughout the season and is shown to support a more diverse and abundant bumblebee community than single meadows (Hatfield and LeBuhn 2007).

Landscape connectivity on the Custer Gallatin National Forest is important for the populations of many species, because due to urbanization, agricultural intensification, and other human activities, habitat is becoming increasingly fragmented, which is known to have strong effects on pollinator communities and plant visitation (Steffan-Dewenter and Tscharntke 1999, Wettstein and Schmid 1999). Large uninterrupted tracts of native vegetation, such as on the Custer Gallatin, provide areas of refuge for pollinators in an otherwise fragmented habitat. Wild habitat heterogeneity reflects variation in natural habitat types, while habitat fragmentation is caused by human disturbance (such as, farms, grazing, and development). Land use intensification and habitat fragmentation do not only affect pollinator diversity and abundance, but also the effectiveness of pollination services (Jennersten 1988). Moreover the distance of insect-pollinated populations to high-quality habitats for pollinators affects their pollination and reproductive success (Steffan-Dewenter and Westphal 2008). Habitat fragmentation can result in the local extirpation and extinction of species by a number of mechanisms acting alone or in combination. Such mechanisms include invasion by exotic competitors or predators, reduced immigration, disturbance in the surrounding matrix, edge effects, changes in community structure, and reduced population sizes (Turner 1996). The Custer Gallatin contains more areas of native plant diversity than adjacent lands, and are generally excluded from development and major permanent disturbances. In densely forested landscapes, National Forest System roadsides may provide areas of additional forage for pollinators in an otherwise limited environment.

Climate change is expected to affect the range of pollinators, the range of their food (native plants), the timing of their food (phenology of wildflowers shifting to earlier in the season), and the gap that can exist between when food is available and when the pollinator species are present on the Custer Gallatin over time. Growing seasons of native plants at high elevation sites are usually much shorter in duration than at lower elevation sites. A one-week shift in flowering at a subalpine meadow with a six-week flowering period may have a more significant effect on network structure compared to the same shift in a lower elevation site with a twelve-week long flowering season. Some pollinators may be unable to shift with their key plant species. Plant species have been observed over the past couple decades shifting spatially toward the poles (higher latitudes) as well as flowering earlier in the growing season. Climate can also influence changes in rainfall type and precipitation amount, temperature (which corresponds with pollinator activity), water availability and snowmelt, timing of flowers and floral rewards, and habitat composition (Bronstein et al. 1990, Burkle and Alarcon 2011). Precipitation is a primary factor controlling plant growth and flowering in rangelands, specifically shifting patterns, frequencies, and durations and intensities of droughts, as well as various human water-extraction schemes. The timing and amounts of soil moisture strongly impacts the rangeland wildflower communities upon which bees depend (Cane 2011). Shifts in precipitation amount, seasonality, and variability under future climates remains highly uncertain. Climate change is expected to change the composition of pollinator communities, but effects and pollinator ability to adapt to these changes are uncertain.

Herbivory

Herbivory is a disturbance agent typically in rangeland ecosystems. Its effect on succession depends on a number of factors including the level of grazing, timing, frequency, kind of herbivore, and existing seral condition of the vegetation. Herbivory effects can be from grazing and browsing by livestock, bison, big game animals, beaver and other wildlife.

Bison

Bison were common before settlement, and the density of cactus and lack of grass reported by explorers and trappers suggests that grazing was severe in some areas (Lesica and Cooper 1997). By the middle of the 19th century, bison were exterminated, and cattle replaced them as the primary grazers. In the latter part of the century, livestock grazing was also severe up until the crash of the industry following the winter of 1887 (ibid). Lesica and Cooper (1997) found no evidence that livestock grazing had any greater impacts on the upland vegetation than grazing by bison and that there may be more grass now than before settlement or the end of open range. However, some of the changes in riparian or terrace vegetation in the past 100 to 150 years may be due to differences in grazing behavior between bison and cattle. Early descriptions of bison grazing in southwestern Montana suggest that they spent little time in riparian areas but grazed primarily in the uplands. On the other hand, livestock spend a good deal of time grazing in riparian areas during summer. Declines in some willows may also be partly attributed to livestock grazing (Tucker Schulz and Leininger 1990, Bryant et al. 2004).

Livestock

Currently, approximately 22 percent of the Custer Gallatin National Forest consists of primary rangeland where permitted livestock generally graze (8 percent of the montane units and 86 percent of the pine savanna units). Current prescribed stocking rates, use levels, season of use, and duration of use are well below what existed before the establishment of the Custer and Gallatin National Forests. As an example, a summary of historic grazing records for the Pryor Mountains indicate that current forage offtake by permitted livestock is about 14 percent of the use that was occurring in the early 1900s. During the 40s to 60s, stocking rates were reduced, seasons of use were shortened, and cross-fencing for pasture rotation to increase the opportunity for rangeland recovery occurred. Further seasonal restrictions occurred to improve entry dates relative to rangeland readiness. Based on monitoring, other more recent stocking rate reductions have been implemented on several allotments, typically ranging from 10 to 30 percent and as high as 50 percent.

Since the 1986 Forest Plan timeframe, animal unit months permitted on the Custer Gallatin have decreased 23 percent. Animal unit months permitted on the Gallatin portion of the Custer Gallatin National Forest have decreased 42 percent and animal unit months permitted on the Custer portion have decreased 19 percent. The changes in Gallatin units were primarily due to closing long-standing vacant allotments as well as some stocking rate adjustments. The changes in the Custer units were primarily made to respond to range readiness issues and carrying capacity and stocking rate issues.

For a variety of reasons, 59 allotments (primarily cattle) have been formally closed on the Gallatin portion of the Custer Gallatin National Forest since the 1986 Forest Plans. Nine of the 59 closures were done through decisions made in the 1986 Forest Plan while the remaining 50 have been closed since then. Closures were typically done after years of allotments being vacant and were based on allotment viability, logistics, and economics of operations, limited access, ownership changes from land exchanges, failing infrastructure, grizzly bear conservation, and other wildlife considerations.

High historic levels of grazing use across the Custer Gallatin National Forest a century ago were responsible for maintaining large acreages in early to mid-seral condition and for over-utilization in many areas. Reducing grazing use over the last several decades has contributed to improving primary rangelands and plant structure needs of other animals such as for nesting birds, invertebrates, fawn cover, etc. Properly managed by vegetative type and within habitat capacities, ungulate herbivory tends to provide for a mix of seral stages and plant structures across broad landscapes. High-intensity use, repeated use during times of rapid plant growth, frequent use of individual plants or plant communities, or longer periods of use tend to push vegetation toward the early-to-mid stages with lower plant structure. Lighter, shorter, or less frequent use tends to result in a higher percentage of mid and late seral stages with higher plant structure.

Big Game

Big game populations are less predictable. Higher numbers of big game species will move or maintain more acres of rangeland vegetation to an early or mid-seral condition (for example, elk in the meadows and more open grassland types, deer and antelope in shrublands, grasslands and riparian areas, and moose in riparian, wetlands and willow stands); lower numbers of big game allow more acres to move to a late seral stage.

In addition, seasonal use, such as big game moving up in elevation or turning livestock out too early following spring green-up, can result in herbivory when plants are most vulnerable. This can set back succession and damage wet soils. In the same way, seasonal and intense use on palatable shrubs such as willow can retard succession and result in undesirable vegetative or soil conditions.

Browsing and grazing of mesic shrubs and deciduous broadleaf seedlings can be detrimental to successful stand establishment and maintenance. Some areas may need to be fenced, depending upon extent and location of burned or treated areas or otherwise managed to control use by cattle and wild ungulates until the young trees are big enough to avoid being detrimentally grazed or browsed, which can be when a tree is over ten feet tall in elk habitat and with a fairly strong bole (girth).

Currently in Montana, elk and deer populations are generally stable to increasing across the Custer Gallatin and moose populations are declining in some areas. On the Ashland and Sioux Districts, elk numbers have increased. In South Dakota on the Sioux Ranger District, elk have recently established breeding herds with an estimate of 150 animals within the greater northwest corner of South Dakota (all land ownerships) (South Dakota Game, Fish and Parks correspondence 9/21/2018). Wintering populations of a variety of wildlife species in the Gardiner Basin are causing high use levels on some areas of winter range that in turn result in heavy use of riparian areas and hay fields on deeded lands below the Forest. There is potential for further grazing pressure in the north and west bison tolerance zones on the Gardiner and Hebgen Lake Districts.

Beaver

Beaver are key agents of riparian-wetland succession because the dams they build act as hydrologic modifiers. When a beaver dam is constructed, a flowing stream can be changed to a pond. This in turn can lead to aggradation of the channel, establishment of floodplains, and raising groundwater levels. Elevated water tables also help to keep water in areas that would be otherwise dry during summer months and also during drought. This helps to sustain plant and animal life and has been shown to increase productivity of a variety of species (Bouwes et al. 2016).

Riparian shrublands typically occupied by dense willow or riparian shrub cover has often been associated with beaver activity where the slope is flat, but sufficient to move water through the system of stable dams. Generally, there is little herbaceous undergrowth due to the high shrub canopy cover. Associated community types include all tall and low willow types, alder, birch, redosier dogwood, and hawthorn, etc. (Hansen et al. 1995). Other deciduous broadleaf riparian shrubs and trees also contribute material and food needed for beaver habitat. There are ongoing beaver relocation projects within the Ashland and Sioux geographic areas that have resulted in the establishment of dams and improved riparian conditions in some areas.

Historically, riparian communities developed in close proximity to water and were more extensive (structurally and geographically) than those which currently exist due to channel impacts and land allocations such as railroads, log drives, diversions and dams, river recreation, timber harvest, improper grazing, and beaver trapping (Dodds et al. 2004, Wohl 2005). Beavers were instrumental in the creation and maintenance of willow, alder, birch, and aspen stands. Water table during historical times were much closer to the surface due to the creation of beaver ponds therefore, soil moisture was more available to support extensive stands of riparian vegetation. Wildlife, primarily bird species, which are tied to riparian communities were probably maintained at a higher population level than those currently documented. In some locations, historic floodplains now appear as dry upland benches, which support little if any riparian vegetation.

The scarcity of cottonwood early in the 19th century appears to be due to beaver (Lesica and Cooper 1997). By the middle of the century, beaver populations had been greatly reduced by trapping, and cottonwoods were able to mature in many riparian areas. Extensive stands originating during the last 100-150 years are now declining. These declines, in part, may be a natural result of tree age. However, decline and an apparent lack of adequate recruitment along some reaches is probably a result of diversion and impoundment (Lesica and Cooper 1997) and domestic and wild ungulate browsing effects.

The near elimination of beaver not only affected the storage and release of water in streams, but also resulted in changes in the riparian vegetation. As dams broke and water tables lowered, vegetation once associated with saturated soils (for example, willows) began to die out. This in turn allowed for greater penetration of the streamside zone by livestock, which accelerated the decline in woody vegetation by browsing and structural damage.

Willows dominated riparian areas along smaller order streams. Beaver decreased willow abundance, but they increased available willow habitat by raising the water table over substantial areas. The decline of beaver due to trapping in the late 19th century likely caused a decline in willows in headwaters areas (Lesica and Cooper 1997).

Beaver populations have declined across much of the Custer Gallatin due to reductions in woody forage species from livestock grazing impacts, mining, road construction, and access related activities. Due to human conflicts with beavers in drainages with roads, beaver are often trapped and eliminated or trapped and translocated by state agencies. Fire suppression is also a factor as riparian areas can convert from the cottonwood, aspen, green ash, and willow species preferred by beavers towards coniferous tree species under the prolonged absence of fire. This reduction in beaver populations and activities creates an altered system that is less able to absorb or compensate for factors that add stress to aquatic systems. Trapping was likely a factor in beaver decline along individual streams, but habitat degradation would need to be addressed before recolonization would occur.

Composition

One broad depiction of composition for existing vegetation is lifeform. Lifeform is based on the type of dominant vegetation from the following broad categories: grass, forb, shrub, tree, transitional forest, and other types that include areas of sparse vegetation, water or urban areas. In the montane areas, tree life forms (conifer and broadleaf) occupy 62 percent of the landscape, transitional forest (recently burned forested vegetation) occupies seven percent, shrub life forms occupy 2 percent, and grass life forms occupy 13 percent. In the pine savanna unit, tree life forms (conifer and broadleaf) occupies 31 percent of the landscape, transitional forest (recently burned forested vegetation) occupies 14 percent, shrub life forms occupy 3 percent and grass life forms occupy 51 percent (VMap). The potential for forested conditions are estimated to be higher than existing forested cover types, which is due to recent (about the last 20 years) large-scale wildfires shifting existing vegetation.

The composition of existing vegetation is further characterized by *dominance types* or *cover types*, which describe the species making up the plurality of vegetation (Barber et al. 2011, Milburn et al. 2015). *Dominance types* describe the most common plant species present. *Cover types* are groupings of dominance types that are used to simplify analysis for the broad scale. Because the Custer Gallatin contains relatively few tree species, the composition of forested vegetation is characterized by dominance types while cover types are used to describe other, more species-rich vegetation types. Dominance type and cover type describe assemblages of species, and are named after the most dominant species. Information on how dominance types are determined is found in Barber and others (2011), and a description of cover types is found in Milburn and others (2015) and appendix B.

For forested vegetation, in addition to dominance type, analysis of vegetation composition is also portrayed and analyzed in terms of tree species presence, for example, the geographic distribution of a species regardless of its relative dominance. When considered together, these two attributes provide a clearer picture of the overall forest composition, diversity and species distribution than either would alone. Tree species presence indicates the proportion of an area where there is at least one live tree per acre of a given species. This measure gives an indication of how widely distributed the species is, although it is not necessarily dominant or even common in all the places it occurs. Most stands are composed of more than one tree species. As noted above, dominance types are named for the dominant species. However, individual species may also be found in multiple dominance types. Therefore, the estimates for a dominance type are not the same as the distribution of the individual tree species.

Coniferous Forest

The following provides a summary of the ecological role and current condition of the five major coniferous tree species found on the Custer Gallatin National Forest: Douglas-fir, ponderosa pine, lodgepole pine, Engelmann spruce, subalpine fir and whitebark pine. Other common tree species including Rocky mountain juniper, limber pine and deciduous species are addressed in sections below. Figure 3 displays the current and desired conditions for forest dominance types, figure 4 displays the current and desired conditions for species presence and table 35 lists the major tree species that will be addressed and summarizes the desired trend in relative abundance and distribution.

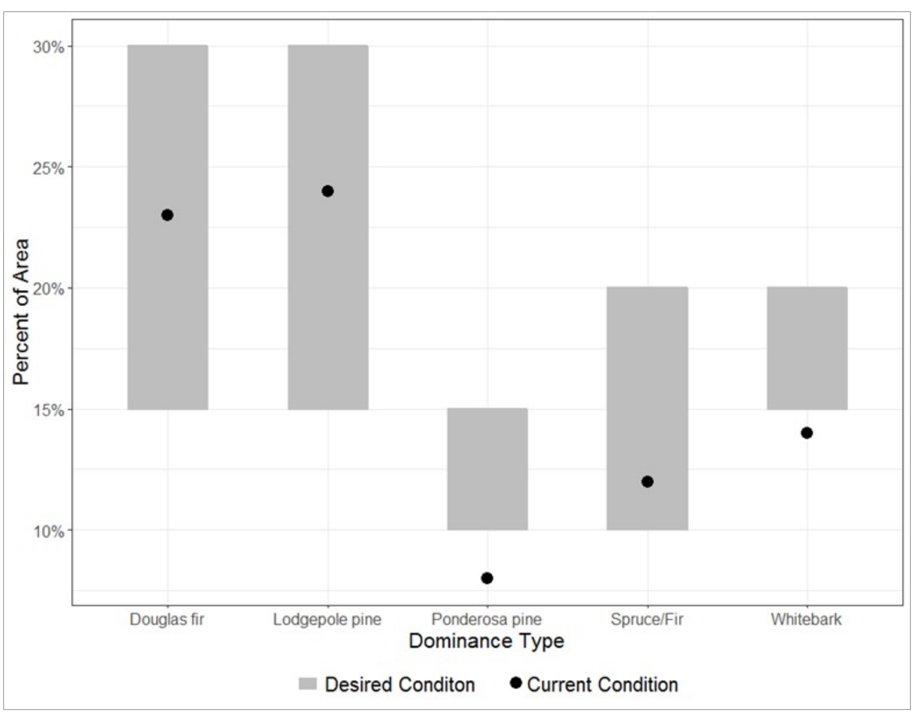

Figure 3. Current and desired conditions of dominance types (current condition is based on VMap data)

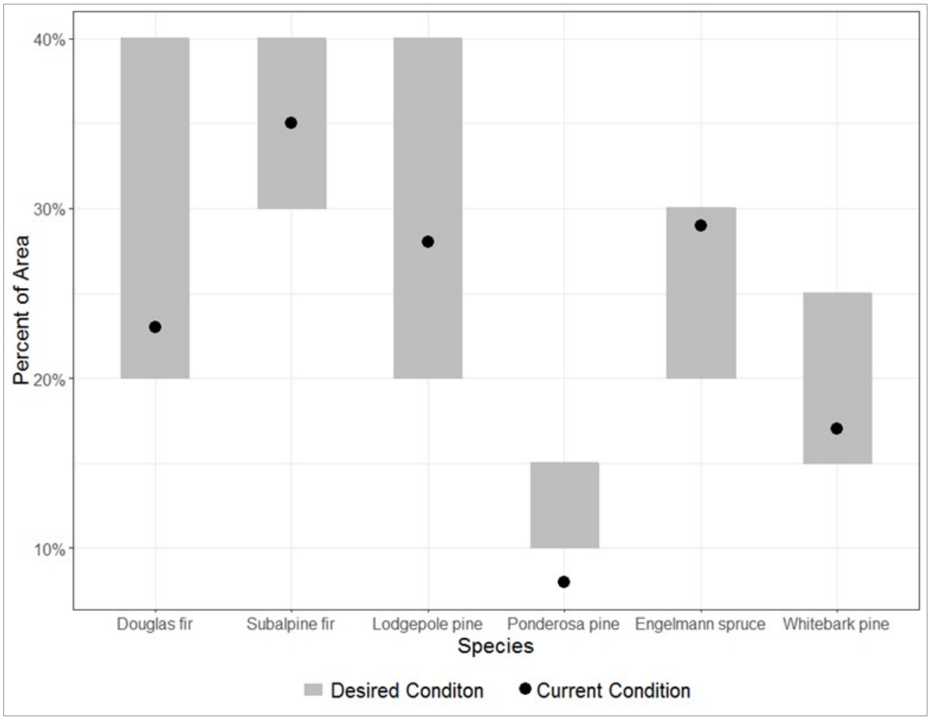

Figure 4. Current and desired conditions of species presence (current condition is based on forest inventory and analysis data)

Table 35. Desired trends over time for coniferous tree species on the Custer Gallatin

Species	Desired trend dominance type (Forestwide)	Desired trend species presence (Forestwide)
Ponderosa pine	Increase, where soil types indicate non-meadows and non-grasslands with focus on sites previously dominated by ponderosa pine that have not regenerated after recent severe wildfires	Increase, particularly in large size classes
Douglas-fir	Maintain	Maintain near current levels, particularly maintain large size classes in low density at xeric ecotone
Lodgepole pine	Maintain or trend downward	Maintain
Subalpine fir / Engelmann spruce	Maintain or increase current condition, particularly in Canada lynx habitat	Maintain, particularly in mid and understory canopy,
Whitebark pine	Increase, particularly in areas best suited for species success (due to less competition)	Increase in all size classes

Ponderosa Pine

Ponderosa pine (*Pinus ponderosa* var. *scopulorum*) is a shade-intolerant, drought-adapted species of the low-elevation dry forests of the Northern Rockies. It is the only conifer type found in the pine savanna ecosystems. Ponderosa pine dominance type provides important wildlife habitat, particularly as late-successional or old-growth forest on the warm dry potential vegetation type. It is a “drought avoider,” meaning it tolerates dry soil conditions by efficiently closing stomata to avoid water loss and xylem cavitation and stay alive during deep droughts. Ponderosa pine has been associated with several species of ectomycorrhizae, giving it a high capacity to survive in dry environments. Throughout the region, natural regeneration is sporadic; it is best when there is a heavy seed crop followed by favorable weather during the next growing season. Ponderosa pine has a great capacity to survive fire, better than nearly all of its competitors. The most damaging of the tree-killing insects are several species of Dendroctonus and Ips. Currently, the presence and dominance of ponderosa pine is below desired conditions. This is primarily due to large, severe wildfires in the Ashland ranger district which reduced forest cover there by 47 percent relative to the 1990s (U.S. Department of Agriculture 2014). While mature ponderosa pine will likely handle increasing temperatures and deeper, longer droughts with only moderate difficulty, the species is vulnerable to additional reduction in range on the Custer Gallatin National Forest if it is unable to successfully regenerate after severe wildfire.

Douglas-fir

Rocky Mountain Douglas-fir (*P. menziesii* var. *glauca*) is one of the most common and important tree species on the Custer Gallatin National Forest. This is largely due to the wide range of site and forest conditions under which it is able to grow and compete successfully. On low-elevation xeric sites, Douglas-fir is associated with ponderosa pine, juniper, and quaking aspen. At upper elevational limits, the species is often found with lodgepole pine, subalpine fir, and Engelmann spruce. Older, larger Douglas-fir trees are tolerant of fire, though less so than ponderosa pine or western larch. The species is a “drought tolerator” in that it keeps stomata open to extract soil water at extremely low soil water potentials, thereby subjecting it to potential xylem cavitation and potential death. Trees can live for many centuries and grow to large diameters. These larger, old trees provide wildlife habitat values, though as snags they typically have less longevity than larch. Douglas-fir is one of the most susceptible conifer species on the Custer Gallatin to serious damage from a variety of insect and diseases which are expected to increase under warming climate. These include Douglas-fir bark beetle, western spruce budworm, and several root diseases and heart rot pathogens. Insect and disease impacts may alter forest structures and forest fuels, increasing susceptibility to high severity fire. With warming temperatures and a possible decrease in summer moisture, Rocky Mountain Douglas-fir may contract from the driest portions of its range.

Subalpine Fir and Engelmann Spruce

Subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*) are widely distributed, major components of mid- to high-elevation forests. At mid-elevations, spruce and fir are often found with Douglas-fir and lodgepole pine. Subalpine fir is usually the climax tree species in most subalpine areas of the Northern Rockies, although it sometimes shares climax status with spruce as both species are shade tolerant and fire intolerant. Pure Engelmann spruce communities are found in seasonally wet areas and riparian settings, and in severe frost pockets where all frost-sensitive tree species are excluded. In part due to fire suppression policies, spruce-fir cover types have generally increased in Northern Rockies. In particular, prevalence in understory and density has increased, particularly at the lower elevation extent of their distribution. In contrast, at higher elevations, where forests are generally characterized by more infrequent, high intensity fire; the distribution of subalpine fir and Engelmann spruce and have likely been less impacted by fire suppression. Subalpine fir has recently made gains at the upper tree line as it replaces rust- and beetle-killed whitebark pine. The future of subalpine fir and Engelmann spruce will depend on their likely expansion in the upper subalpine as climate change creates increasingly suitable habitat; countered by possible reductions in the drier, lower extent of their range due to increased fire, drought and associated pathogens. Climate change may allow longer growing seasons and higher productivity in subalpine communities where cold and snowpack duration limit regeneration and growth. Production and regeneration are likely to increase, especially in those high mountain environments where water is rarely limiting. In particular, increased presence is expected where snow historically controlled regenerative success. Moreover, subalpine fir may increase as it replaces rust- and beetle-killed whitebark pine at the upper end of its distribution in the Greater Yellowstone Ecosystem (though whitebark pine can also facilitate subalpine fir establishment by ameliorating harsh environmental conditions). Seedling establishment may be the bottleneck for subalpine fir and Engelmann spruce in the future as years that meet these conditions may be less frequent in the future in the lower subalpine. Andrus et al. (2018) showed that large establishment events of spruce and fir occurred in years of high soil moisture availability and suggested that potential declines in the frequency of establishment events due to climate change are likely to compound the effects of increasing mortality from fire and drought.

Lodgepole Pine

Lodgepole pine (*Pinus contorta*) has wide ecological amplitude, but only the inland form (*P. contorta* var. *latifolia*) is found on the Custer Gallatin National Forest. Lodgepole pine has the widest range of environmental tolerance of any conifer in North America. It is relatively resistant to frost injury and can often survive in frost pockets where other species cannot. Compared to other associated species, lodgepole pine is intermediate in its needs for water, requiring more than Douglas-fir or ponderosa pine but less than spruce and subalpine fir. Lodgepole pine is intolerant of shade but highly tolerant of frost and drought. In the absence of fire, lodgepole pine is usually succeeded by its more tolerant associates, such as Douglas-fir in xeric environments and Engelmann spruce and subalpine fir in subalpine environments. It is seral in most communities. However, on cool dry habitats, such as those found in the Greater Yellowstone Area, it is dominant and tends to be persistent and form near-climax communities. Lodgepole pine has a great ability to regenerate due to a combination of cone serotiny, high seed viability, early rapid growth, and ability to survive a wide variety of microsite and soil conditions. Large quantities of stored seeds are available for regeneration after fire, and annual seedfall from nonserotinous cones helps restocking in areas of relatively minor disturbance and maintaining lodgepole pine presence in mixed stands. On the Custer Gallatin National Forest, most of the season’s total germination occurs during the two weeks following snowmelt in late June when soil is saturated and temperatures most favorable. Typically, many Northern Rockies lodgepole pine forests originated from stand-replacement fires, but extensive fire scars in Northern Rockies lodgepole pine forests indicate the existence of a low-severity, nonlethal fire regime component in these forests. However, most lodgepole pine forests in the region have a mixed-severity fire regime in space and time, where all fire severity types are possible depending on available fuels, antecedent drought, and wind conditions. Consequently, lodgepole as a species will be well adapted to the fires of the future. Repeated fires, however, can eliminate lodgepole pine seed sources if the fires occur before existing lodgepole has become reproductively mature (approximately 10 years). In most cases, lodgepole pine natural regeneration often overwhelms a burned site with abundant seed from serotinous cones and thereby excludes other species. The mountain pine beetle is the most important insect pest and has played a significant role in the dynamics of lodgepole ecosystems. Recent findings have shown that fire and beetles often act independently to influence lodgepole pine dynamics. In response to climate change, lodgepole pine is expected to both expand and contract in range depending on the particular model and assumptions used (Halofsky et al. 2018a), but as long as fire remains on the landscape, the species is likely to maintain its presence on the Custer Gallatin National Forest at roughly the same proportions as during the last 100 years.

Whitebark Pine

Whitebark pine is listed as a candidate species by the U.S. Fish and Wildlife Service, and information on this species is discussed in further detail in the At-Risk Plants section of this environmental impact statement. A brief summary will be provided here.

Whitebark pine is most common on sites in the cold potential vegetation type. It competes best and most often achieves dominance on the harsher, exposed sites. It usually occurs in association with subalpine fir, spruce and sometimes lodgepole pine. It occurs as a minor species in some stands at mid elevations, typically associated with lodgepole pine and subalpine fir. The species is a key ecosystem component of high elevations forests, where it was historically a dominant and widespread species at all stages of forest succession. As the most fire resistant and long-lived species in these forests, it plays an important role in the stability of these high elevation ecosystems and in the quality of wildlife habitat.

In the cold potential vegetation type where this species plays the most important ecological role, whitebark pine presence is well below desired conditions. Maintaining or increasing these levels is desired, both forestwide and especially in the cold potential vegetation type. The species has experienced extensive mortality over the past few decades due to the exotic disease white pine blister rust, as well as other factors such as mountain pine beetle. Almost the entire range of whitebark pine in the Greater Yellowstone Area was affected by mountain pine beetle during this latest epidemic and approximately 50 percent of the area showed severe mortality and 36 percent moderate mortality as indicated by the change in overstory condition (Macfarlane et al. 2013). Though whitebark pine still occurs across the landscape, most trees are small size classes (seedling/sapling or small size class), and larger trees are very scarce across much of its range. This has greatly reduced its regeneration potential. Subalpine fir has increased in abundance with the loss of whitebark pine and the lack of fire and regeneration of whitebark pine.

Mesic Deciduous Woodlands

Woody Draws

About 11,400 National Forest System acres of woody draws (green ash woodlands) occur on the Ashland and Sioux Districts. As a rare and biologically important landscape component, green ash woodlands should be managed to maintain or perpetuate a network of multi-layer and multi-age class of herbaceous plants, shrubs, and trees. Green ash is on the western and most arid margin of its range on the Ashland and Sioux Districts and is likely at the limit of its environmental tolerances. Because of this, extended periods of drought may have an adverse effect on regeneration and probably promote other problems. The current condition of green ash draws may be a reflection more of past (1880 to 1930) grazing pressure than of recent livestock grazing and wildlife use (Lesica and Marlow 2013). Also, conifer invasion of woody draws causes competition and shades out hardwood species. Within primary rangelands of permitted livestock allotments on the Sioux and Ashland Districts, 19 percent of inventoried green ash woodlands are functional, 61 percent are at risk, and 20 percent are non-functional. The at risk and non-functional sites are largely a product of legacy issues due to woodcutting, livestock grazing, deer browsing, introduction of invasive rhizomatous sod grasses (predominantly, Kentucky bluegrass), and periods of prolonged drought. Tree recruitment is reduced by competition with sod grass and conifer invasion. Project level allotment management planning provides a mix of grazing prescription changes to address these conditions. They include reduced stocking rates, improved distribution techniques such as proper salting and off-site water development, and reduced grazing duration and timing considerations. Regardless, there continues to be a need for improved grazing practices and monitoring in woody draws, riparian areas, and in wetlands.

The distribution and structure of green ash woodlands on the Custer Gallatin have been affected by fire exclusion, conifer and non-native grass invasion, wild ungulate browsing, and livestock grazing. Fire exclusion has contributed to expanding stands and density of ponderosa pine with greater competition over green ash and greater risk of stand-replacing fire. Low-elevation ponderosa pine forests of the northern Rocky Mountains historically experienced frequent low-intensity fires that maintained open uneven-aged stands, but fires today are more often conifer stand-replacing fires. Green ash sprouts following fire, allows for regeneration of the species and decadent stands. About 25 percent of the Ashland's and 16 percent of the Sioux's green ash woodlands are mixed forest and mixed savannah dominance types which may be indicative of ponderosa pine colonization into green ash woodlands.

The Sioux and Ashland Districts have experienced large-scale wildfires in the past 18 years that have affected green ash woodlands. Some stands in the Long Pines of the Sioux District experienced reburn effects as well (1988 Brewer Fire and 2002 Kraft Springs Fire) setting back recovery. Post-fire recovery depends largely on the pre-fire conditions in the ground level understory. Many of these burned stands had enough sod development to impede green ash seedling/sapling establishment and it is unlikely that functional stand conditions will return in these areas. Green ash recovery in post-fire settings appears to be most successful where there is less sod and more litter and duff.

The northwestern Great Plains semi-arid environment is marginal for tree growth, and green ash is at the western, most arid margin of its range in eastern Montana. Green ash is primarily a tree of humid to sub-humid climates, occurring mainly in bottom lands. Hydrology is an important limiting factor for the growth of green ash in the Sioux and Ashland geographic areas. According to Lesica and Marlow (2013), in the first decade of the 21st century, winter (December-February) precipitation was approximately 25 percent lower than the 20th century average and winters averaged more than 3 degrees Fahrenheit warmer than in the last century in southeast Montana. These conditions can result in reduced snow accumulations, early spring flows and the deep water penetration into the soil compared to the past. Hydrologic conditions conducive to recruitment and growth of green ash seedlings may have been sporadic, even prior to the introduction of Eurasian sod grasses into the woodland understory (Lesica and Marlow 2013). These conditions may be even less common now in a warmer, drier climate.

An increase of more drought-tolerant, grazing and browsing-adapted species and a decline in green ash tree seedling recruitment might be expected with a decrease in precipitation even in the absence of grazing or reduction in browsing (Lesica and Marlow, 2013). More open stands are associated with drier sites or regions. It is likely that the future climate of the northwestern Great Plains, in particular, might be characterized by decreased precipitation, increased temperature and increased frequency of extreme climatic events. Such changes could make recruitment of green ash from seed a rare occurrence in many stands at the arid edge of this species' geographic range (Lesica and Marlow 2013). However, sprouting may still occur.

Green ash has a broad ecological amplitude and can survive droughty conditions, but it grows optimally on moist sites. As soil moisture declines with a warmer, drier climate, marginal sites may become less favorable for regeneration and survival of young green ash trees. With increased fire frequency, there will likely be increased vegetative regeneration and decreased production of seedlings following fire; fire often kills green ash seed on or near the soil surface, restricting seedling recruitment to surviving seed-producing trees. Green ash may benefit from increased temperatures, because seedling and mature tree growth may increase with increasing soil temperatures. However, those green ash populations associated with moist upland microsites (such as, northeast facing residual snow-loaded depressions) may experience severe drought stress as snowpack declines and melts sooner, and regeneration may decrease, eventually resulting in loss of those communities (Halofsky et al. 2018b).

Since most mature green ash communities are somewhat resistant to wildland fire, given that the species can sprout afterward, the projected increases in fire in the future may not impact most green ash stands, especially the moist communities. Low-severity fires might promote regeneration by thinning stands and stimulating sprouting; green ash has both root crown and epicormic sprouts, and both are typical following fire events, especially in the woody draws and riparian areas of the Great Plains. High severity fires, however, may result in mortality. Browsing pressure on green ash communities will also likely increase with increased drought, as upland grasses and forbs desiccate and senesce earlier, or are replaced by invasive, less palatable species (Halofsky et al. 2018b).

Aspen and Cottonwood

Aspen and cottonwood (black, narrowleaf and plains cottonwood) communities are highly valued for their contribution to biodiversity and habitat. These communities are not abundant in the Custer Gallatin National Forest. There are about 13,600 acres of aspen and 430 acres of cottonwood (less than 1 percent of the land area). Aspen occurs primarily as small groves at middle and low elevations and cottonwood are found at lower elevation, in higher stream order environments. Due to large scale wildfires, the Long Pines on the Sioux District are showing a large release and increase in aspen stands that were previously not well represented on the landscape in recent history. To help with recovery, ponderosa pine may need to be thinned or removed from these regenerating stands.

While there are stable climax aspen communities, most aspen is a fire-maintained, early seral component of a forested community. Stressors include competition with and shading by conifers, typically due to fire exclusion, domestic and native ungulate herbivory, and increasing temperature coupled with declining precipitation. Reduction of soil moisture may cause severe water stress which reduces aspen’s ability to survive (for example, sudden aspen decline) and to reproduce both vegetatively and by seed. Similar stressors exist for cottonwood. Through deposition of alluvial material and scouring, flooding often produces suitable establishment sites for cottonwood. Until roots reach the water table, trees are susceptible to drought.

Aspen re-colonized the bare land surface following the retreat of the glaciers about 12,000 years before present (BP). During 10,000-8,000 BP the climate was warmer and moister than it is now. Since then, there has been progressive cooling and drying, so that current conditions are not as good for effective seedling regeneration(Halofsky et al. 2018b). Aspen is also shade intolerant, and its seedlings are very sensitive to competition from pre-existing vegetation; it has been able to persist and spread largely because of its ability to reproduce asexually through root suckers. Following natural disturbance through agents such as fire, windthrow, or insect defoliation, aspen has re-established itself as the dominant tree species in the early successional stages of mixed wood formations largely through asexual reproduction from remnant roots.

Aspen is a species that may experience both gains and losses under future climate, depending on local site conditions, particularly soil moisture. Aspen communities on warmer, drier sites could experience high mortality because of increasing water deficit. Ireland and others (2014) found that drought was the major factor causing recent high mortality in southwestern aspen stands. In the boreal forests of western Canada, Hogg and Hurdle (1995) estimate that even with an 11 percent increase in precipitation, boreal forests in which aspen is a major component will decline due to drought stress. Sudden aspen decline has been associated with severe prolonged drought, particularly in aspen stands that are on the fringe of the species' distribution (warmer and drier sites than those typically considered optimal for aspen persistence) (Frey et al. 2004). Recent research efforts have found that extreme weather events (such as, drought, thaw–freeze events), insect defoliation, and pathogens have led to aspen mortality (Halofsky et al. 2018b). Marchetti and others (2011) found that aspen mortality from various insects and disease was greater in those stands that were drought-stressed and declining due to sudden aspen death. Further exacerbating the situation is that declining stands may have little or no regeneration due to intense ungulate herbivory, and those smaller stands that persist may be smaller and fewer with increased plant stress due to increased severity of summer droughts (Rogers et al. 2013). Increased fire frequency, particularly on moist sites, will likely favor aspen regeneration by removing shading conifers, and younger stands (under 40 years old) created by fire may be more resilient to drought. However, if fires are severe, they may kill the shallow root systems and eliminate aspen. Increased herbivory on regenerating stands may occur as adjacent upland vegetation ages and dries out earlier in the growing season. Areas with mountain pine beetle-caused conifer mortality (especially in lodgepole pine) may release aspen, and it will regenerate once the conifer canopy is thinned or removed, again given sufficient soil moisture (Halofsky et al. 2018b).

In the western part of the Custer Gallatin, the black cottonwood (*Populus balsamifera ssp. trichocarpa)* is dominant with narrowleaf cottonwood (*Populus angustifolia*) and eastern cottonwood (*Populus deltoides*) occurring as co-dominants in the riparian-floodplain interface near the mountains. Further east, narrowleaf cottonwood and Plains cottonwood become dominant. In relatively undisturbed stands, willow (*Salix* species), redosier dogwood (*Cornus sericea*) and common chokecherry (*Prunus virginiana*) form a thick, multi-layered shrub understory, with a mixture of cool and warm season graminoid species below. Green ash (*Fraxinus pennsylvanica*) and box elder (*Acer negundo*) form a tree understory in mid-seral and late-seral stands.

As snowpack declines and melts earlier with the trend of warming temperatures, there will be reduced, attenuated river flows (loss of extreme high and low flows), along with a possible shift in timing of peak flows to earlier in the season, before cottonwood seed is viable for germination. These shifts in timing, magnitude and variability may reduce both germination and establishment of young cottonwoods (Whited et al. 2007). There will also likely be increased human demands for water in the future, which will likely result in additional diversions and reservoir expansions. Any alteration of hydrologic flow regime (for example, timing, magnitude and duration) will affect both floodplain interaction and available water to cottonwoods, which in turn may reduce recruitment and establishment of seedlings (Auble and Scott 1998, Beschta and Ripple 2005). Decreased stream flows and floodplain interactions may result in a conversion of streamside vegetation from cottonwood to upland species, along with reduced growth and regeneration (recruitment) and increased mortality of cottonwood (Beschta and Ripple 2005). Upland conifers (such as, Engelmann spruce, lodgepole pine, and Douglas-fir) typically establish once the stream and local water table have dropped, and they can shade out the remaining cottonwoods. In addition to competition from upland conifers, there may also be increased browsing pressure on cottonwoods, which will further contribute to declines in cottonwood regeneration and recruitment. Plains cottonwood may be more persistent under changing climate because of greater plant available soil water in the unsaturated zone (as a result of finer textured soils) in its habitat. Black and narrowleaf cottonwood typically occur in coarser substrate, which will become much drier as flows are lower and recede earlier than in the past, or are attenuated due to diversions. Seedling and sapling mortality may increase in these species. Plains cottonwood regeneration occurs with episodic flooding, whereas black and narrowleaf cottonwood regenerate with 1-3 year bankfull flow return intervals (typically an annual recruitment cycle); therefore, plains cottonwood will likely be more adapted to irregular flows that may occur with climate trends. Black and narrowleaf cottonwood will likely be at greater risk to changing climate because of soil water characteristics in their habitats and their narrow amplitude in terms of germination and flood events on specific fluvial surfaces(Halofsky et al. 2018b).

Xeric Woodlands

There are about 750 acres of limber pine woodland cover type (only in the montane portions of the Custer Gallatin) and 5,800 acres of juniper woodland cover type present in all the geographic areas.

Limber Pine

Limber pine (*Pinus flexilis*) is a shade-intolerant, early seral to pioneer species in the Northern Rockies (Steele 1990 in: Burns and Honkala 1990) which includes the montane geographic areas of the Custer Gallatin. Its seeds are dispersed by rodents, but more importantly, by a bird (Clark's nutcracker) that will cache limber pine seed anywhere within the microsite pattern that it uses for finding the seed (Lanner and Vander Wall 1980). Limber pine has difficulty in competing with other encroaching species on more productive mesic sites and is often succeeded by Douglas-fir and subalpine fir. This tree species is very slow growing but long-lived, and some of the oldest trees in the region are limber pine. Limber pine occupies xeric sites across a wide range of elevations (2,600 to 8,900 feet in elevation) in the Northern Rockies region that are often marginal for timber production (Jackson et al. 2010).

Historically, it was often found on the margins between grasslands and forest ecosystems at the lower tree line. Because limber pine is easily killed by fire, the species was mostly found in fire-protected cove sites where fire was rare and of low severity, such as rocky outcrops, barren areas, and moist north slopes (Steele 1990 in: Burns and Honkala 1990). In these lower tree line areas, limber pine is often associated with Douglas-fir, ponderosa pine, and quaking aspen. On upland montane sites, it can often be found on limestone substrates and droughty soils, but in these areas it is associated with many other Northern Rockies conifers, especially lodgepole pine, subalpine fir, and Engelmann spruce (Langor 2007).

Limber pine seedlings are poor competitors with grass, but do well on rocky substrates and in shrub environments. Limber pine is very tolerant of drought and can establish and grow in some of the most arid environments in the Northern Rockies region (Steele 1990 in: Burns and Honkala 1990). Seedlings are very drought tolerant but have a low tolerance to competition, especially from herbaceous plants. The fundamental and realized niche for limber pine is very broad in the region, indicating that this species has a generalist adaptive strategy.

The thin bark and low foliage of limber pine make the species highly susceptible to damage from wildland fire. Limber pine is also highly susceptible to white pine blister rust, and many communities suffer high mortality when the disease infects trees in a new region (Smith et al. 2013). Limber pine also facilitates the expansion of currant (*Ribes* spp.; an alternate host for the rust pathogen *Cronartium* *ribicola*) into traditional grasslands (Baumeister and Callaway 2006), thus increasing rust infections and mortality. Other insects and pathogens are also impacting limber pine, but at a severity much lower than *C. ribicola*. Some researchers have detected mortality from mountain pine beetle in parts of the limber pine range (Jackson et al. 2010). Others have noted that limber pine stands on mesic sites may have severe dwarf mistletoe infections that could result in mortality levels similar to those observed from white pine blister rust. Porcupine damage is also prevalent east of the Continental Divide.

With fire exclusion, limber pine has expanded its range from fire-protected cove sites into areas where it was historically restricted by frequent fires (Arno and Gruell 1983, Brown and Schoettle 2008). As a result of the diminished fire activity and active nutcracker caching, limber pine has expanded into grass and shrub rangelands (Halofsky et al. 2018b). Evidence suggests that limber pine can facilitate the establishment of other forest species, especially Douglas-fir, in rangeland settings (Baumeister and Callaway 2006). As a result, limber pine in the Northern Rockies region is currently occupying areas that were traditionally grasslands, and it is difficult to determine if this is inside or outside the range of variability of this ecosystem.

Limber pine is a generalist and pioneer species, as well as cold and drought tolerant, making it capable of growing in a wide variety of environmental and physiological circumstances. Even though general trends across the west show some declines due to exotic white-pine blister rust infections, native mountain pine beetle outbreaks, and continued fire exclusion, its presence and distribution on the Custer Gallatin exceed that which has been modelled as its natural range of variation. This is likely due to past fire suppression.

Some anticipate that warming temperatures on the east side of the northern region of the Forest Service, along with increasing but more-variable precipitation, especially during the growing season, and waning snowpack will result in increased growth in many limber pine communities (Ashton 2010). Increased vigor is usually accompanied by larger cone crops, higher seed viability, greater number of seeds per cone, wider seed dispersal, and greater resistance to disease. Increased seed dispersal includes denser caching by birds and mammals, and probably more distant caching by Clark’s nutcracker. Increased vigor might also extend to competitors of limber pine, so there could be increased competition from wind-dispersed conifers, especially on the more mesic portions of the limber pine range (Halofsky et al. 2018b).

Warm temperatures, even with increased precipitation, could also result in drier conditions, especially for seed germination and seedling growth. Even if more seeds are cached by mammals and birds, the subsequent establishment of seedlings from the unclaimed caches might be low because of longer drought seasons and hotter ground temperatures. Any dispersal of limber pine seed to new areas, especially non-forested stands, might have limited regeneration success because of the lack of ectomycorrhizal associations and increased competition from grasses and dense shrubs (Coop and Schoettle 2009).

Disturbance interactions with warming climates are likely to be important to future limber pine dynamics. Increasing fire frequency and intensity may result in the burning of more limber pine stands, causing higher mortality (Coop and Schoettle 2009). Increased fire may stem the encroachment of limber pine into grasslands. If future fires are larger and more severe, there may be less competition from other competing conifers, especially in the eastern portions of the Northern Rockies region along the timber-grassland ecotone. Warmer, drier conditions may also reduce blister rust infection by disrupting the blister rust cycle, especially during the late summer when *Ribes* species-to-pine infection occurs, and there may be fewer wave years where temperature and humidity are optimal for pine infection by white pine blister rust. Where precipitation is projected to increase, such as in the eastern portions of the Northern Rockies region, there may be higher rates of blister rust and dwarf mistletoe infection, which may cause higher limber pine mortality. Continued fire exclusion could enhance establishment of currant under mature limber pines and result in even greater white pine blister rust infection and mortality. Warmer temperatures also favor expansion of alternate host species such as currant, lousewort (*Pedicularis* spp.) and Indian paintbrush (*Castilleja* spp.) (Keane et al. 2015).

Limber pine responses to future climates may be minor and governed mostly by wildland fire and white pine blister rust. If fires increase, limber pine forests, some of which are already declining from rust, will suffer major declines, especially where they have encroached as a result of fire exclusion. Given its minor role in the Northern Rockies region prior to European settlement, this species is considered to be at most moderately vulnerable to climate change based on its high tolerance to drought and ability to populate severe environments, but high susceptibility to the introduced white pine blister rust (Halofsky et al. 2018b).

Juniper

Rocky Mountain juniper (*Juniperus scopulorum*) is a minor vegetation cover type on the Custer Gallatin but known from all geographic areas. Rocky Mountain juniper communities in the Sioux and Ashland geographic areas are often restricted to steeper, north-facing slopes. Individuals may be scattered across other foothill areas in the montane geographic areas of the Custer Gallatin, such as rocky outcrops, butte tops, draws, and floodplains. Rocky Mountain juniper forms open woodland with sagebrush and grasses, and it is often found mixed with Douglas-fir (*Pseudotsuga menziesii*) or ponderosa pine (*Pinus ponderosa*). It is also found along waterways in pure stands or as understory in the cottonwood (*Populus* species)-willow (*Salix* species) habitat types. It can form pure stands at middle and low elevations on the Custer Gallatin.

The Utah juniper (*Juniperus osteosperma*) ecological system occurs most frequently on moderately steep to very steep slopes in the Pryor mountain range which is on the northern extent of its range. It occurs on rocky outcrops on south and southwestern aspects and forms small- to large stands on dry and rocky soils. Rocky Mountain juniper (*Juniperus scopulorum*) can also occur with Utah juniper in the Pryor Mountains. Conifers such as Douglas-fir (*Pseudotsuga menziesii*), limber pine (*Pinus flexilis*) and ponderosa pine (*P. ponderosa*) may also occur in some stands. Other co-dominant shrubs include mountain big sagebrush (*Artemisia tridentata ssp. vaseyana)* and rubber rabbitbrush (*Ericameria nauseosa*). Other low shrubs such as snakeweed (*Gutierrezia sarothrae*) and fringed sage (*Artemisia frigida*) are common. Undergrowth is dominated by bunchgrasses, usually bluebunch wheatgrass (*Pseudoroegneria spicata*), needle and thread (*Hesperostipa comata*), Indian ricegrass (*Achnatherum hymenoides*) or Idaho fescue (*Festuca idahoensis*).

Juniper presence and distribution on the Custer Gallatin are considered to be within their natural range of variation on xeric sites due to lack of fuels to typically carry a fire and outside of their natural range of variation on mesic sites that would typically be periodically opened from more natural fire regimes that have tended to be suppressed over time.

Even though prolonged drought, potential for increased fire severity and exotic species invasion can change the dynamics of these juniper systems, Rocky Mountain and Utah Juniper communities are considered to be stable on the Custer Gallatin (Montana Natural Heritage Program, 2018). It is expected that juniper to handle increasing temperatures and deeper, longer droughts with only moderate difficulty. Its ability as a “drought avoider” to close stomata when soil water potential is low which allows juniper to maintain its presence in many low elevation settings (H Stout and Sala 2003).

Grasslands and Shrublands

Grasslands

Pine Savanna Grasslands

The Ashland and Sioux geographic areas of southeastern Montana and northwestern South Dakota are within the Northern Great Plains ecosystem. Annual precipitation increases from west to east changing from dry temperate steppe to humid temperate prairie. The mixed grass prairie occurring within the Ashland and Sioux geographic areas. Vegetation is a mixture of mid- and short-statured grasses with a mix of warm-season (C4) and cool-season plant (C3) species. The C refers to carbon and the number is the number of carbon atoms in the first compound produced by photosynthesis. The two groups have different growth requirements, responding differently to temperature, moisture and light. Warm season grasses require higher temperatures and light with lower requirements for moisture. For cool season grasses, it is the opposite. The presence of both C3 and C4 species can be desirable in an area as they can occupy different niches (for example, C3 species are often more abundant in the shade of trees and on southerly aspects, while C4 species often dominate full-sun conditions and northerly aspects) and thereby provide greater groundcover across a range of conditions. It is not uncommon to find both C3 and C4 species in one area. This has advantages in providing a broader spectrum of production throughout the year for grazers.

Perennial herbaceous components of the Northern Great Plains grasslands consist mostly of rhizomatous and bunch-form graminoids, with a diversity of perennial forbs. Typical grassland vegetation types are characterized by wheatgrass/needlegrass in the west and wheatgrass/bluestem (*Andropogon* spp.)/needlegrass to the east. Rhizomatous western wheatgrass (*Pascopyrum smithii*) is often the dominant component, especially on finer-textured soils and where the moisture balance is favorable. Other grasses include thickspike wheatgrass (*Elymus lanceolatus*), green needlegrass (*Nassella viridula*), blue grama (*Bouteloua gracilis*), Sandberg’s bluegrass (*Poa secunda*), and needle and thread (*Hesperostipa comata*). Dryland rhizomatous sedges such as threadleaf sedge (*Carex filifolia*) are common. Common forbs within this system include yarrow (*Achillea millefolium*), scarlet globemallow (*Sphaeralcea coccinea*), western sagewort, (*Artemisia ludoviciana),* boreal sagewort (*Artemisia frigida*), silver lupine (*Lupinus argenteus*), penstemon (*Penstemon* species), prairie cinquefoil (*Potentilla gracilis*), Hood’s phlox (*Phlox hoodii*), sandwort (*Arenaria* species), prickly pear (*Opuntia* species), prairie clover (*Dalea purpurea*), gayfeather (*Liatris punctata*), and milkvetch (*Astragalus* species)and Missouri goldenrod (*Solidago missouriensis*). Overall shrub cover is less than 10 percent in this cover type and may include shrubs such as Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), silver sagebrush (*Artemisia cana*) and greasewood (*Sarcobatus vermiculatus*).

Precipitation and temperature have been reliable predictors of the extent and distribution of plant groups in the Northern Great Plains (for example, cool-season C3 and warm-season C4 species (Epstein et al. 1997; Knapp et al. 2001)), which includes the Sioux and Ashland geographic areas. Changes in these drivers have implications for vegetation. Rising carbon dioxide levels may complicate these relationships in the future, however. For instance, warmer and drier conditions should favor C4 grasses

(Knapp et al. 2001, Halofsky et al. 2018b); but rising carbon dioxide should favor C3 species (Halofsky et al. 2018b). Further complicating these relationships are changing temperature and precipitation regimes. Increased variation, intensity, and changes in the timing of precipitation can also influence species composition and productivity of rangelands. For example, as springtime temperatures increase, the extent and magnitude of cheatgrass infestations may increase.

Soil water availability and water stress are principal driving factors in these semi-arid grasslands; influencing plant species distribution, plant community composition and structure, productivity, and associated social and economic systems of the Northern Great Plains. Soil water availability is influenced by complex interactions among temperature, precipitation, topography, soil properties, and ambient CO2 (Ghannoum 2009, Morgan et al. 2011).

Available soil water is unevenly distributed across landscapes and a function of landform, topography, and soil properties. Soil moisture loss through evapotranspiration is influenced by slope, aspect, and solar loading at the ground surface; and water holding capacity is influenced by soil properties. These characteristics in the Northern Great Plains may modify the effects of climate change and elevated CO2 locally. Landscape patterns of available soil water may result in uneven patterns of vegetation change and productivity under changing temperature and moisture regimes and elevated CO2 levels. The desiccating effect of higher temperature and increased evaporative demand (Morgan et al. 2011) is expected to offset the benefit of higher precipitation, resulting in lower soil water content and increased drought throughout most of the Great Plains (Morgan et al. 2011). Elevated CO2 may counter the effects of higher temperatures and evaporative demand by improving water-use efficiency of plants (Morgan and others 2011).

Rising CO2 and temperature combined with increased winter precipitation may favor some forbs and woody plants (Morgan et al. 2008). Plant productivity is expected to increase with projected changes in temperature and moisture combined with elevated CO2 (Morgan et al. 2008). Forage quality may decline as a result of less available forms of soil nitrogen and changes in plant species and functional groups (Morgan et al. 2008). A major shift in functional groups from C3 to C4 plants is possible but uncertain, because warmer temperature and longer growing seasons favor C4 grasses, but the effects of higher CO2 on water-use efficiency may benefit C3 grasses. Because most invasive species are C3 plants, they may become more problematic with the benefits of increased CO2 (Morgan et al. 2008).

The adaptive capacity of Great Plains grasslands during the 1930s and 1950s drought was documented for the central plains (Weaver 1968). There was a shift in C4 grasses, in which big bluestem and little bluestem were replaced by the shortgrass species blue grama and buffalograss. Shifts from tallgrass prairie to mixed grass prairie were also documented with an increase in the C3 plants western wheatgrass and needlegrass. This shift was later reversed during the higher precipitation period of the 1940s, indicating an adaptive capacity of Great Plains grasslands to the effects of long-term drought. These shifts were also affected by grazing condition of the grasslands prior to the drought.

Within the Northern Great Plains near the Ashland geographic area, (Ellison and Woolfolk 1937) documented the effects of a sustained drought near Miles City, Montana that peaked in 1934; this drought was aggravated by above-average temperatures and preceding years of below-normal precipitation. They documented substantial death of pine, juniper, and cottonwood, but also noted declines in sagebrush and other species. All shrubs experienced considerable dieback. Grass cover was reduced by up to 79 percent depending on the species. Effects of the drought were multiyear despite a favorable season in 1935. Needle-and-thread grass (*Hesperostipa comata*) and Sandberg bluegrass (*Poa secunda*) were able to recover relatively quickly, despite mortality, through the establishment of new seedlings. Stands of big sagebrush experienced considerable mortality and did not regenerate, whereas silver sagebrush (*Artemisia cana*) was able to resprout from the base.

Montane Grasslands

Within the montane units of the Custer Gallatin (Pryor, Absaroka-Beartooth, Bridger/Bangtail/Crazy, and Madison/Gallatin/Henry Mountain geographic areas), montane grassland vegetation is dominated by cool-season perennial bunchgrasses and forbs, with sparse shrub and/or tree representation. Various shrub and tree species often occur with low cover (typically less than 10 percent). The grasslands on the more moist north and east facing slopes, or at higher elevations, are generally dominated by Idaho fescue (*Festuca idahoensis*), and other cool season grasses. Other common grasses include bluebunch wheatgrass (*Pseudoroegneria spicata*), tufted hairgrass (*Deschampsia caespitosa*), mountain brome (*Bromus carinatus*), blue wildrye (*Elymus glaucus*), awned sedge (*Carex atherodes*), and small wing sedge (*Carex microptera*). Forb dominated meadows usually comprise a wide species diversity which differs from montane to subalpine elevations. Montane grasslands range in size from small patches to large open parks located on montane to foothill zones.

Other montane graminoids include western needlegrass (*Achnatherum occidentale*), Richardson's needlegrass (*Achnatherum richardsonii*), oatgrass (*Danthonia* species), prairie junegrass (*Koeleria macrantha*), Sandberg's bluegrass (*Poa secunda*), western wheatgrass (*Pascopyrum smithii*), thickspike wheatgrass (*Elymus lanceolatus*), basin wildrye (*Leymus cinereus*), and Liddon sedge (*Carex petasata*). These moister sites support a forb- rich community that includes species such as arrowleaf balsamroot (*Balsamorhiza sagittata*), yarrow (*Achillea millefolium*), silky lupine (*Lupinus sericeus*), sticky geranium (*Geranium viscossisimum*), nine-leaf biscuitroot (*Lomatium triternatum*), sticky cinquefoil (*Potentilla glandulosa*), prairie cinquefoil (*Potentilla gracilis*), penstemons (*Penstemon* species), little larkspur (*Delphinium bicolor*), crazyweed (*Oxytropis* species), prairie gentian (*Gentiana affinis*), wild strawberry (*Fragaria virginiana*), and Indian paintbrush (*Castilleja* species). Shrub cover is usually less than 10 percent and includes species such as shrubby cinquefoil (*Dasiphora fruticosa),* Woods' rose (*Rosa woodsii*), snowberry (*Symphoricarpos* species), and common juniper (*Juniperus communis*). Serviceberry (*Amelanchier alnifolia*), Douglas hawthorn (*Crataegus douglasii*), and common chokecherry (*Prunus virginiana*) often occur as patches on north-facing slopes of foothills where snow persists longer into the growing season.

Most montane grassland species regrow quickly after fire but as fires become hotter and more frequent, there is an increased risk of mortality of native species and invasion by non-native plant species. However, recent research in western Montana grasslands indicates that some grassland species may persist under less than optimal conditions, and that invasive plants may not always readily establish and dominate (Ortega et al. 2012, Pearson et al. 2016). In addition, more spring and winter precipitation may facilitate exotic annual grasses, particularly cheatgrass which germinates in the winter/early spring, to establish and set seed earlier than native perennial grasses (Finch 2012). This creates an uncharacteristic, continuous fine fuel load that is combustible by early summer, burning native perennial grasses often before they have matured and set seed (Chambers et al. 2007, Bradley 2009). Other non-native species, such as spotted knapweed (*Centaurea stoebe*), Dalmatian toadflax (*Linaria dalmatica*), butter-and-eggs (*Linaria vulgaris*), and sulphur cinquefoil (*Potentilla recta*) respond favorably after fire and can increase in cover and density.

Non-native invasive plant species will expand into; or if already established, increase in abundance; in the lower elevation montane grassland communities, regardless of level of disturbance, as these communities become warmer and drier. The rate and magnitude of infestation will likely increase with greater disturbance (Bradley 2009). In addition, drier site conditions coupled with ungulate effects (grazing, browsing, hoof damage) may increase bare ground along with associated increases in surface soil erosion (Washington-Allen et al. 209). Low-elevation montane grasslands may shift in dominance towards more drought tolerant species. Some model output suggests that cool season (C3) grasslands will decline and that warm season (C4) grasslands will expand based solely on temperature trends. However, research indicates that elevated CO2 favors C3 grasses and enhances biomass production, whereas warming favors C4 grasses due to increased water use efficiency (Morgan et al. 2004, Morgan et al. 2007). Although C3 grasses dominate Western montane grasslands, a warmer and drier climate may allow C4 grasses (primarily northern Great Plains grasses) to expand westward into these grasslands. In general, it is likely that with increased warming and more frequent fires, grasslands will become a more dominant landscape component as shrublands and lower montane conifer forests are burned and less able to regenerate. However, increasing fire would also encourage more invasive species in grasslands (D'antonio and Vitousek 1992, Bradley 2009).

Shrublands

Pine Savanna Shrublands

Pine savanna (Sioux and Ashland geographic areas) foothill shrublands usually occur as small dense thickets, narrow bands, or irregular patches. Shrub cover ranges generally from 30 to 100 percent. Chokecherry (*Prunus virginiana)* is frequently the dominant shrub species and others include American plum (*Prunus americana*), hawthorn (*Crataegus* species), currant (*Ribes* species), skunkbush sumac (*Rhus trilobata*), western snowberry (*Symphoricarpos occidentalis*), serviceberry (*Amelanchier alnifolia*), elderberry (*Sambucus* spp.), birchleaf spiraea (*Spiraea betulifolia*), and boreal sagewort (*Artemisia frigida*).

The persistence of many animal species depends on the existence of sagebrush steppe habitat. The greater sage-grouse (*Centrocercus urophasianus*) and other sagebrush obligate animals depend on landscapes of intact habitat of sagebrush and perennial forbs and grasses for their persistence. The majority of the priority and general greater sage-grouse sagebrush habitat on the Custer Gallatin occurs within the Ashland and Sioux geographic areas (National Forest System and private inholdings). About 1,880 acres of priority greater sage-grouse habitat is found at the lower elevation fringes in the southwestern portion of the Slim Buttes of the Sioux geographic area. About 102,380 acres of the general greater sage-grouse habitat is found on the Sioux and Ashland geographic areas. Wyoming big sagebrush is an important component of the greater sage-grouse priority and general habitats. However, Wyoming big sagebrush (*Artemesia tridentata ssp. wyomingensis*) and silver sagebrush (*A. cana*) are the dominant sagebrush species within South Dakota’s occupied sage-grouse range (South Dakota Game, Fish and Parks 2014) on or near the Sioux Ranger District. Three hundred and sixty-four acres of priority Wyoming big sagebrush habitat on the Sioux geographic area (16 percent of priority habitat on the Custer Gallatin) recently experienced low severity wildfire effects likely causing some mortality. Silver sagebrush is not as susceptible to fire as other species of sagebrush and mortality after prescribed fall and spring burns is typically related to fire intensity (White and Currie 1983). Silver sage also sprouts following top-kill by fire (Wright et al. 1979). Of the approximate 139,885 acres of the general greater sage-grouse habitat found on the Sioux and Ashland geographic areas, approximately 13,800 acres (about 10 percent of the general habitat) recently experienced moderate to high mortality due to wildfire effects. Wyoming big sagebrush may require in excess of 100 years to reestablish to pre-burn stature and density.

About 100 percent of priority and about 82 percent of the general sage-grouse habitats in the Ashland and Sioux geographic areas of the Custer Gallatin occur within grazing allotments. The existing condition of grassland and shrublands, including greater sage-grouse priority and general habitats, varies across the landscape. In general, they have shown improvement over time with the advent of cross-fencing to move most units from season long to rotation grazing, installing offsite water developments (away from riparian and hardwood draw areas), implementing improved range readiness entry dates, and implementing shorter duration grazing with more opportunity for plant recovery. In addition, several stocking rate reductions have also occurred over time. This is not to discount that there continue to be some areas where issues are still being assessed and managed for improvement. There continues to be a need for improved grazing practices and monitoring in these areas.

Communities Dominated by Wyoming Big Sagebrush and Basin Big Sagebrush
Although the current distribution of Wyoming big sagebrush and Basin Big Sagebrush occur in both the montane and pine savanna ecosystems of the Custer Gallatin, the majority occurs within the Sioux and Ashland geographic areas. Wyoming big sagebrush distribution increases from west to east. The distribution of basin big sagebrush habitats is generally restricted to deeper soils of lower elevations, often including alluvial fans.

Lesica and others (2007) suggest that fire return intervals for Wyoming big sagebrush are longer than for basin big sagebrush and mountain big sagebrush, ranging from 50 to about 150 years at the xeric end of the range of Wyoming big sagebrush (Baker 2006). The long fire return intervals to which Wyoming big sagebrush is adapted are related to its very slow post-fire recovery, as low as 2 percent 23 years after fire (Lesica and others 2007). The slow recovery of these systems is partly due to slow growth rates and harsher environmental conditions in many sites in the Northern Rockies and Northern Great Plains. In contrast, basin big sagebrush canopy cover development and growth are much faster than for Wyoming big sagebrush (McArthur and Welch 1982, Booth et al. 1990). Slow growth can be exacerbated by invasive annual grasses such as cheatgrass. Cheatgrass invasion poses a continued and heightened threat to big sagebrush ecosystems in the future, because its biomass production and fire frequency are projected to increase in response to rising temperature and CO2 levels (Ziska et al. 2005, Westerling et al. 2006).

Basin big sagebrush ecosystems on the Custer Gallatin are minor. It has some capacity to adapt to climate change. There is high diversity in topography, soils, and climate in this type of sagebrush, suggesting that it can withstand a relatively broad range of ecological conditions and may tolerate shifting climatic conditions. Various subspecies of basin big sagebrush often hybridize and have a high level of polyploidy, providing it with the capacity to undergo selection and adapt to shifting climatic regimes relatively quickly (Poore et al. 2009).

Shrublands Dominated by Sprouting Sagebrush Species (Silver Sagebrush and Threetip)
The main sprouting sagebrush on the Custer Gallatin is silver sage and occurs predominantly on the Sioux and Ashland geographic areas. Threetip sagebrush may only occur in very minor amounts on the lower elevations of the western edge of the Custer Gallatin, such as near the southwestern edges of Hebgen Ranger District, and as such, will not be discussed further.

Silver sage can sprout from the root crown following top kill (primarily from fire) (Bunting et al. 1987). With increased fire severity and frequency, there may be some mortality, but overall this species will generally resprout. Silver sage occur on mesic sites and typically occupies moist riparian benches or moist toeslopes. Although this species will sprout, increased fire frequency and severity may cause a shift in community composition to dominance by fire-adapted herbaceous species or non-native species.

Other fire-adapted shrub species (such as, rubber rabbitbrush, green rabbitbrush, spineless horsebrush) may increase, particularly following fire. In addition, more spring and winter precipitation may facilitate exotic annual grasses to establish and set seed earlier than the native perennial grasses, particularly in lower-elevation communities (Bradley 2008, D'Antonio and Vitousek 1992). This creates an uncharacteristic, continuous fine fuel load that can burn by late spring/early summer, burning sagebrush and native grasses often before they have matured and set seed (Chambers and Pellant 2008). Other non-native invasive species (such as, spotted knapweed, Dalmatian toadflax, butter-and-eggs, sulphur cinquefoil) respond favorably after fire, and if present, will increase in cover and density.

Silver sage is fire adapted and is likely to sprout successfully. Historical fire return intervals for silver sage are relatively short, typically less than 40 years. With warming trends, understory composition may possibly shift to more xeric grassland species (such as, bluebunch wheatgrass, needle-and-thread), which are more adapted to warmer and drier conditions. With warming trends, silver sage may shift landscape position to sites with more moisture and cooler temperature (such as, higher elevation, lower landscape position, and northeast aspects) (Halofsky et al. 2018c).

Montane Shrublands

Within the montane units of the Custer Gallatin (Pryor, Absaroka-Beartooth, Bridger/Bangtail/Crazy, and Madison/Gallatin/Henry Mountain geographic areas), mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*) and snowfield sagebrush (*Artemisia tridentata ssp. spiciformis)* are typically found in higher elevations with mountain big sagebrush dominating. Wyoming sagebrush (*Artemisia tridentata spp. wyomingensis*) and silver sagebrush (*Artemisia cana ssp. viscidula*) can be co-dominant on some lower elevation sites. Antelope bitterbrush (*Purshia tridentata*) may co-dominate, but as a co-dominant is of very limited occurrence, being found primarily on intrusive volcanics such as on the Hebgen Lake District. Little sagebrush (Artemisia arbuscula) occurs sporadically. Other shrubs may be present, but usually at low cover values (5-10 percent). Species include rubber rabbitbrush (*Ericameria nauseosa*), and green rabbitbrush (*Chrysothamnus viscidiflorus*), wax currant (*Ribes cereum*), Woods rose (*Rosa woodsii*), deerbrush ceanothus (*Ceanothus velutinus*), snowberry (*Symphoricarpos* species) and serviceberry (*Amelanchier alnifolia*). Forb species may include arrowleaf balsamroot (*Balsamorhiza sagittata*), Indian paintbrush (*Castilleja* species), cinquefoil (*Potentilla* species), fleabane (*Erigeron* species), phlox (*Phlox* species), milkvetch (*Astragalus* species), prairie smoke (*Geum triflorum*), lupine (*Lupinus* species), buckwheat (*Eriogonum* species), yarrow (*Achillea millefolium*), and rosy pussytoes (*Antennaria rosea*).

Priority greater sage-grouse habitat is not found within the montane geographic areas of the Custer Gallatin. However, about 30,095 acres of the general greater sage-grouse habitat is found in all montane geographic areas, predominately in the Pryor Mountains of the Beartooth Ranger District. Mountain big sagebrush and Wyoming big sagebrush are important components of the greater sage-grouse general habitats in these montane landscape areas. Minor amounts of mountain big sagebrush mortality was caused by mixed severity fire effects on general sage-grouse habitat in the Pryor Mountains in the recent past. Mountain big sagebrush is easily killed by fire and often requires ten to 35 years or longer to reestablish to pre-burn stature and density, which is faster than recovery of burned Wyoming sagebrush.

Wyoming big sagebrush may require in excess of 100 years to reestablish to pre-burn stature and density.

About 75 percent of the general greater sage-grouse habitat on the montane units of the Custer Gallatin occur within grazing allotments. The existing condition of grassland and shrublands, including greater sage-grouse general habitats, varies across the landscape. In general, they have shown improvement over time with the advent of cross-fencing for rotational grazing, installing offsite water developments (away from riparian areas), and implementing shorter duration grazing with more opportunity for plant recovery. In addition, several stocking rate reductions have also occurred over time.

Mountain Big Sagebrush

Mountain big sagebrush is killed by fire. With increased fire severity and frequency, there will be a shift in community composition to dominance by fire-adapted shrub and herbaceous species and possibly non-natives. Fire-adapted shrub species (such as, rubber rabbitbrush, green rabbitbrush, white horsebrush) may increase in abundance following fire (Fischer and Clayton 1983, Smith and Fischer 1997). In addition, more spring and winter precipitation may facilitate non-native annual grasses (particularly cheatgrass which germinates in winter/early spring]) establishment, although this is less likely in cooler, moister mountain big sagebrush communities compared to lower elevation Wyoming and basin big sagebrush communities. However, with a warmer, drier climate, the conditions may be conducive to cheatgrass establishment. An abundance of cheatgrass creates an uncharacteristic, continuous fine fuel load that can burn by late spring/early summer, burning sagebrush and native perennial grasses often before they have matured and set seed (Pellant 1989, Chambers et al. 2007), especially in the Great Basin. However, other research in the northern edge of the Great Basin indicates that some sagebrush communities may be less susceptible to cheatgrass invasion following fire, at least under the current climate (Lavin et al. 2013). Other non-native species (for example, spotted knapweed, Dalmatian toadflax, butter-and-eggs, sulphur cinquefoil) respond favorably after fire and if present, will increase in cover and density.

Historically the fire return intervals in mountain big sagebrush are relatively short (around 40 years) compared to Wyoming big sagebrush (more than 100 years) (Lesica et al. 2005, Heyerdahl et al. 2006, Lesica et al. 2007). Mountain big sagebrush regenerates from seeds shed from nearby unburned plants. It will fully recover between 15-40 years after fire (Bunting et al. 1987), depending on site characteristics and fire severity. In a warmer and drier climate, frequent, high-severity burns (facilitated by cheatgrass) may not cause initial mortality and create unfavorable conditions for post fire regeneration (from sprouting, regrowth, or seed). Because there is no viable sagebrush seed bank, if fires burn large areas and there are no live, seed-bearing sagebrush nearby, there may be a type conversion to grassland. In addition, invasive, non-native species will likely either expand into these areas after fire, or they will increase in abundance due to altered conditions that no longer favor the native plant community (Bradley 2008, D’Antonio and Vitousek 1992).

Mountain big sagebrush is not fire adapted, and may decline in cover and density in response to warmer temperatures and increased fire frequency and severity. Over time, especially if fine fuels such as dried cheatgrass are present, more frequent fires may eliminate mountain big sagebrush from a community (Chambers and Pellant 2008, D’Antonio and Vitousek 1992). However, because mountain big sagebrush occurs at higher elevations, typically on more productive cooler, mesic sites, these communities are typically less invaded by non-native species. However, if these sites become warmer and drier, herbaceous understory composition could shift to more xeric species that are better adapted, and bare ground may increase. As a result, invasive species, particularly cheatgrass, could expand into and establish dominance in these altered communities.

It is possible that mountain big sagebrush distribution may shift to cooler and moister sites (such as, higher elevation, northeast-facing snow-filled depressions). With climate change, it may be able to persist only in sites with higher moisture and deeper soils than the surrounding landscape. Understory composition may shift to more xeric grassland species (such as, bluebunch wheatgrass, needle-and-thread), which are more tolerant of warmer, drier conditions (Halofsky et al. 2018a).

Short Sagebrush Types (Black and Low Sagebrush)

Low and black sagebrush occur in minor amounts on the Custer Gallatin. Low sagebrush sites are characterized as low production areas over shallow, claypan soils that restrict drainage and root growth. Low sagebrush is found on a range of altitudinal gradients. In contrast, black sagebrush is considerably more restricted in ecological amplitude and is found on shallow, dry, infertile soils.

Despite growing across large altitudinal gradients, low and black sagebrush are relatively more limited than other sagebrush systems. Thus, it is reasonable to assume that as climate changes, ranges could be further restricted, resulting in small islands being isolated, although this is more likely for black sagebrush because of its poor competitive ability. Both species depend heavily on seeding for reproduction and recovery from disturbance. In addition, several traits make low sagebrush sensitive to climate change. There is high mortality in the first year of growth (Halofsky et al. 2018c).

Mesic Montane Shrubs

Mesic montane shrubs are typically associated with montane and subalpine forests, and occur as large patches within forested landscapes. Species such as Rocky Mountain maple, alder, thimbleberry, chokecherry, serviceberry, currant, snowberry, and Scouler willow are common. Mesic shrubs are well adapted to frequent fire, and under the right conditions, can actually expand and outcompete regenerating conifers. However, with declining snowpack and warmer temperatures, fires may be hotter and sites may be drier; causing variable amounts of mortality, depending on site conditions.

Mesic montane shrubs are well adapted to frequent fire (Smith and Fisher 1997). Most shrub species sprout vigorously following top kill, primarily from fire, and quickly regain dominance on the site. However, as fires become more frequent and severe, and sites become drier, there may be a shift away from mesic species to more xeric, fire-adapted, sprouting shrubs, such as rubber rabbitbrush, green rabbitbrush, and spineless horsebrush. Non-native invasive plant species may also expand into these communities, particularly following fire (Bradley 2008, D'Antonio and Vitousek 1992). With warmer temperatures and drier soils, some mesic shrub species that occupy moister sites (such as, alder and Rocky Mountain maple) may shift their distribution up in elevation or to cooler, moister sites (such as, northeast facing depressions).

Riparian, Wetlands and Groundwater Dependent Vegetation

Riparian areas are among the most critical elements of biodiversity within the landscape and they provide key ecosystem services available from no other resource. Intermittent streams and seasonal seeps and springs supporting riparian features are also biologically important for hydrological functioning and wildlife in the Northern Great Plains including those of the Sioux and Ashland geographic areas. This includes ecosystem-supporting services such as nutrient cycling; provisioning services such as fresh water, forage and habitat for wildlife; regulating services such as carbon storage, water and flood regulation, water quality, and erosion control; and cultural services such recreation, scientific discovery and education, cultural, intellectual and spiritual inspiration. Riparian areas are often important for recreation and scenic values. Riparian areas contribute to nearby property values through amenity and views. Space is created for riparian sports such as fishing, swimming, bird watching, and launching for vessels. However, because riparian areas are relatively small and occur in conjunction with watercourses, they are vulnerable to alteration and damage caused by people and their activities, such as livestock, mining, and recreational uses. Riparian areas supply food, cover, and water for a large diversity of animals and serve as migration routes and stopping points between habitats for a variety of wildlife. In Montana and South Dakota, many vertebrate species use riparian areas for a good portion of their life cycles, and many of these are totally dependent on riparian areas. Likewise, aquatic and fish productivity are directly related to a properly functioning and healthy riparian habitat. Riparian areas help control nonpoint source pollution by holding and using nutrients and reducing sediment. Tree, shrub, forbs, grass, and grass-like species in riparian areas stabilize streambanks and reduce floodwater velocity, resulting in reduced downstream flood peaks. Where riparian areas are intact and functioning, these ecosystem services can be assumed to be stable; but where riparian areas have degraded or been lost, these services are missing or at risk.

About 78,000 National Forest System acres (3 percent) of riparian (perennial and intermittent) and wetlands occur on the Custer Gallatin. Many groundwater-dependent ecosystems also occur such as seeps and springs. As a rare and biologically important landscape component, riparian areas should be managed to provide shade, to maintain streambank stability and in-stream cover, and to promote filtering of overland flows. Of 273 watershed condition framework-rated watersheds forestwide, 19 percent of the watersheds' riparian vegetation condition component rated as functioning at risk, with the remainder rated as functioning properly. At the allotment scale, the same overall pattern was seen as at the watershed scale where 71 percent of the riparian survey sites in allotments were found to be in proper functioning condition, with 27 percent functioning at risk and 2 percent rated as non-functional. The at risk and non-functional sites are largely a result of legacy issues, including roads, uncharacteristic wildland fire, developed recreation, dispersed recreation, historically unmanaged grazing by livestock, and water development and diversion on and off National Forest System lands. In general, the trend for all riparian areas is up from a long-term perspective due to decreases in stocking rates over past decades, rest due to periodic non-use, and natural recovery from past wildfire events. However, the trend over more recent timeframes is unknown. Project level allotment management planning provides a mix of grazing prescription changes to address these conditions. They include reduced stocking rates, improved distribution techniques such as proper salting and off-site water development, and reduced grazing duration and timing considerations. Regardless, there continues to be a need for improved grazing practices and monitoring in riparian areas along streams, in wetlands, and groundwater dependent ecosystems.

Riparian conservation measures have been developed for Federal, State, and private lands—helping to preserve and protect the integrity of the riparian and wetland habitats as well as the water quality of associated waterbodies. State streamside management zone protections have been applied on the Custer Gallatin during vegetation management projects. Soil and water conservation best management practices have also been applied to management activities.

Perennial stream reaches in higher-elevation areas that have well-timbered valley bottoms and ground-water entry will be most resilient to warming conditions and changing weather patterns. Lower elevation stream reaches, lacking riparian shade, containing high sediment loads, with impaired width-depth ratios, and losing flows to groundwater will be the least resilient reaches to changing conditions. Warmer, drier climates will influence species distributions and successional processes in complex and uncertain ways. Climate change forecasts include reduced precipitation, longer dry periods, and an increased frequency of extreme weather events. The potential effects on intermittent stream ecologies from these aspects of climate change could decrease runoff with more perennial streams becoming intermittent streams, losing hydrologic connectivity and reducing habitat for species dependent on perennial flow.

Prairie streams, such as those found in the Sioux and Ashland geographic areas, are dynamic, tending to vary between periods of floods and flow intermittency, among and sometimes within years. These systems experience regular cycles of drying and rewetting, creating harsh conditions for inhabitants, and repeated recovery sequences (Dodds et al., 2004). Climate change is expected to exacerbate these patterns (Jaeger et al. 2007) and lead to greater extremes, including severe droughts and more intense storms and wet intervals in plains and dryland systems ((Starks et al. 2014, Halofsky et al. 2018b).

Alpine

Alpine communities are common but unique in the high elevations of the montane units of the Custer Gallatin. Approximately 121,000 acres of alpine vegetation occurs on the Custer Gallatin. The Beartooth Mountains are primarily composed of the largest expanse of alpine plateau in the lower 48 states. The alpine vegetation is dominated by various grasses, sedges, small shrubs and forbs that are able to withstand the severe environment characterized by high winds, low humidity, cold soil temperatures, high ultraviolet radiation, short growing season, low soil moisture, and great daily temperature fluctuations.

The alpine vegetation occurs in a mosaic of turf, cushion, grassland, snowbed, and wetland associations. Wind exposure, moisture, and timing of snow release have generally been considered to be the most important environmental factors determining the arrangement of vegetation above tree line. Wind often results in soil and snow removal on windward sites and soil and snow accumulation, along with increased soil development, on lee sites.

Domestic sheep use in the alpine systems on the Custer Gallatin National Forest occurred during the turn of the century. Because of the resource degradation they were causing, permitted livestock grazing has been closed in these alpine areas. Because alpine areas are slow to recover, evidence of past livestock use still remains in some areas. Historic gold mining in areas near the Cooke City area affected some alpine systems. Extensive and costly reclamation to re-establish soil stabilizing vegetation has been conducted.

Elevation will play a large role in plant species composition in conjunction with predicted warming trends. High elevation, alpine or other fringe type environments may see plant species composition change first. Invasive plants apparently have not yet become a serious problem in the alpine tundra of the Custer Gallatin National Forest, although yellow toadflax and Canada thistle are present above 9000 feet and has the potential to invade such areas in the future. Other threats in these settings include recreational use and trail construction/maintenance.

Sparse Vegetation Types

Badlands within the mixed grass regions of the Sioux, Ashland and the south flank of the Pryor Mountains geographic areas are shaped by the carving action of streams, erosion, and erosible parent material. The areas are easily recognized by the rugged, eroded, and often colorful land formations, and the relative absence of vegetative cover. In those areas with vegetation, species can include scattered individuals of many dryland shrubs or herbaceous taxa, including curlycup gumweed (*Grindelia squarrosa*), threadleaf snakeweed (*Gutierrezia sarothrae*), greasewood (*Sarcobatus vermiculatus*), Gardner's saltbush (*Atriplex gardneri*), buckwheat (*Eriogonum* species), plains muhly (*Muhlenbergia cuspidata*), bluebunch wheatgrass (*Pseudoroegneria spicata*), and Hooker's sandwort (*Arenaria hookeri*). Patches of sagebrush (*Artemisia* spp.) can also occur. The steep and deeply eroded slopes of badland systems tend to be harsh environments, which support only species uniquely adapted to these conditions (Brown 1971).

Sparsely vegetated ecosystems can also be found from foothill to alpine elevations throughout the montane landscape areas of the Custer Gallatin. These ecosystems typically occur on steep cliff faces, in narrow canyons, and on smaller rock outcrops of various igneous, sedimentary, and metamorphic bedrock types, and includes the unstable scree and talus slopes that typically occur below cliff faces. These ecosystems are characteristically dry and sparsely vegetated, typically having less than 10 percent plant cover. Although there may be small patches of dense vegetation, the system usually consists of scattered trees and shrubs such as Douglas-fir (*Pseudotsuga menziesii*), Ponderosa pine (*Pinus ponderosa*), limber pine (*Pinus flexilis*), aspen (*Populus tremuloides*), or subalpine fir (*Abies lasiocarpa*). Juniper (*Juniperus* spp.) is common at lower elevations. Shrubs adapted to xeric growing conditions and rocky soils are typically present, for example, currant (*Ribes* species), common ninebark (*Physocarpus malvaceus*), wild rose (*Rosa* species), common juniper (*Juniperus communis*), Lewis mock orange (*Philadelphus lewisii*), creeping Oregon grape (*Mahonia repens*), three leaf sumac (*Rhus trilobata*), American wild raspberry (*Rubus idaeus*) or serviceberry (*Amelanchier alnifolia*). Soil development is limited, as is herbaceous cover. Forbs may include penstemon (Penstemon species), buckwheat (*Eriogonum* species), western sagewort (*Artemisia ludovicana*), Michaux's sagewort (*Artemisia michauxiana*), and spotted saxifrage (*Saxifraga bronchialis*). Because the elevation range is so broad, species composition may vary widely from occurrence to occurrence. Soils are typically thin and poorly developed, and moisture for plant growth is primarily retained in crevices in the rock substrate. Limited soil availability, harsh weather extremes, and water stress impose physiological constraints on plants communities leading to plant species that are uniquely adapted to these conditions. Additionally, within the larger cliff habitat, steep slopes, small ledges, overhangs, cracks and crevices often form a mosaic of microhabitat types (Graham and Knight 2004).

Ecotones (upper and lower tree line)

Ecotones refers to the transition from one ecosystem to another. Ecotones on the Custer Gallatin occur at edges and physical boundaries, such as where lower elevation woodlands become grasslands or shrublands and the upper elevation treelines give way to alpine ecosystems.

Warming trends are expected to cause gradual changes in the abundance and distribution of tree, shrub, and grass species throughout the Northern Rockies, with drought tolerant species becoming more competitive. The earliest changes will likely be at ecotones between lifeforms (such as, upper and lower treelines) (Keane et al. 2018). Ecological disturbance, including wildfire and insect outbreaks, will likely be the primary facilitator of vegetation change, and future forest landscapes may be dominated by younger age classes and smaller trees. High-elevation forests will be especially vulnerable if disturbance frequency increases significantly.

Dry and wet ecotones are considered to be among the most sensitive to warming trends (Means 2011, Wasson et al. 2013). Lower tree line woodlands are often thought to be invading or colonizing into more desirable sagebrush and grass types due to fire exclusion and other management actions such as grazing; however, ecotones also naturally move elevationally based on the dynamics of vegetation, climate and fire (Means 2011). Douglas-fir and ponderosa pine colonization can occur in ecotones and sagebrush/grassland areas. Drivers of this trend include fire exclusion, which would have killed colonizing trees when they were of a small size; grazing, which reduced fine fuel loads and further influenced fire exclusion; and summer droughts that enhanced sagebrush which functioned as nurse plants for establishing conifers.

Forest Structure

Size Class

Tree size is an indicator of the successional stage and age of forests across the landscape. Forest size classes are defined based on the predominant tree diameter in the stand. Size class is expressed here as the mean basal area weighted average diameter. Basal area weighted average diameter is the average diameter of the live trees weighted by their basal area. Basal area weighted average diameter is less influenced by small trees than other methods of calculating a stand's average diameter such as quadratic mean diameter. Since management questions typically are concerned with the larger, dominant and co-dominant trees in a setting, and basal area-weighted average diameter is influenced, to a greater extent, by larger trees, it was selected by the Region 1 Vegetation Council to be used in the Region 1 existing vegetation classification system. Details on how forests are classified by size are described by Barber and others (2011). The five size classes defined for this analysis are shown in table 36. A general association of the size class with tree age and forest successional stage is made based upon knowledge of the successional patterns on the Custer Gallatin National Forest.

Desired conditions for size classes, as well as large and very large trees, are the same across all the revised plan alternatives. These desired conditions would not necessarily apply to the current plans, but are included in the analysis for all alternatives to provide a consistent comparison. The desired conditions for size class reflect our best understanding of resilient forest conditions and based in large part on the natural range of variation analysis. Figure 5 shows the current and desired condition for size class within each Region 1 broad potential vegetation type.

Table 36. Forest size classes

Size Class	Diameter Range	Description
Seedling/ Sapling	0 to 5 inches diameter at breast height	The seedling/sapling size class represents the early successional stage of development. Forests are dominated by seedlings (less than 4 ½ feet tall) and saplings (less than 5 inches diameter). There may be low numbers of overstory larger trees present. Most trees are less than 40 years old and less than 40 feet tall. On sites of lower productivity (higher elevation, poor soils) or in extremely dense stands, trees in in this class may be older because of their slower diameter growth rates. Ample sunlight is able to reach the forest floor and abundant grasses, forbs and shrubs are usually present. When summarizing VMap data, transitional areas (areas recently affected by stand-replacing disturbance) are also included in this size class.
Small	5 to 9.9 inches diameter at breast height	Small size class forests are in the mid-successional stage of development, composed mostly of immature trees 5 to 9.9 inches diameter. Typical tree ages range from 40 to 75 years old. They often have a single canopy layer, but two or more layers are not uncommon, depending on disturbance history and site conditions. Many stands are densely stocked, with limited sunlight reaching the forest floor. Shade tolerant understory grasses, forbs and shrubs dominate. Some forests have a more open canopy where understory plant species requiring greater amounts of sunlight are more prevalent.
Medium	10 to 14.9 inches diameter at breast height	Medium size class forests are also in the mid-successional stage of development, where trees 10 to 14.9 inches diameter dominate. Vertical structures vary considerably. Some forests are densely stocked, where shade tolerant grasses, forbs and shrubs dominate forest floor vegetation. Others are characterized by open densities with shade intolerant plants thriving in the understory. Tree age varies depending on species composition, site conditions, and stand density, but is typically 75 to 110 years old. On sites with harsher growing conditions or in stands of very high densities and low growth rates, trees in this medium size class might be substantially older. Notably, many stands that have a 10-15 inch mean basal area weighted diameter also have many large trees within them. In such cases and depending on the specific circumstances, these stands can potentially be moved from a medium to a large size class by removing small trees that effectively reduce the stand's mean diameter.
Large	Over 15 inches diameter at breast height	Large size class forests are usually older than those in the medium class. Trees greater than 15 inches diameter dominate. Most trees are over 90 years old, and most stands are in the mid or late successional stage of development. There are sites where trees of large tree size classes are substantially younger or much older. Some forests are composed of two or more canopy layers. Some of these forests are open, with shade intolerant plants in the understory, particularly in ponderosa pine. The larger trees are typically over 130 years old, and some may be several centuries in age. Forests are in the late successional stage of development, and some correlate to old growth forest. These forests typically have a more complex structure than other successional stages, with more variability in canopy layers, amounts of snags and down wood, and individual tree sizes.

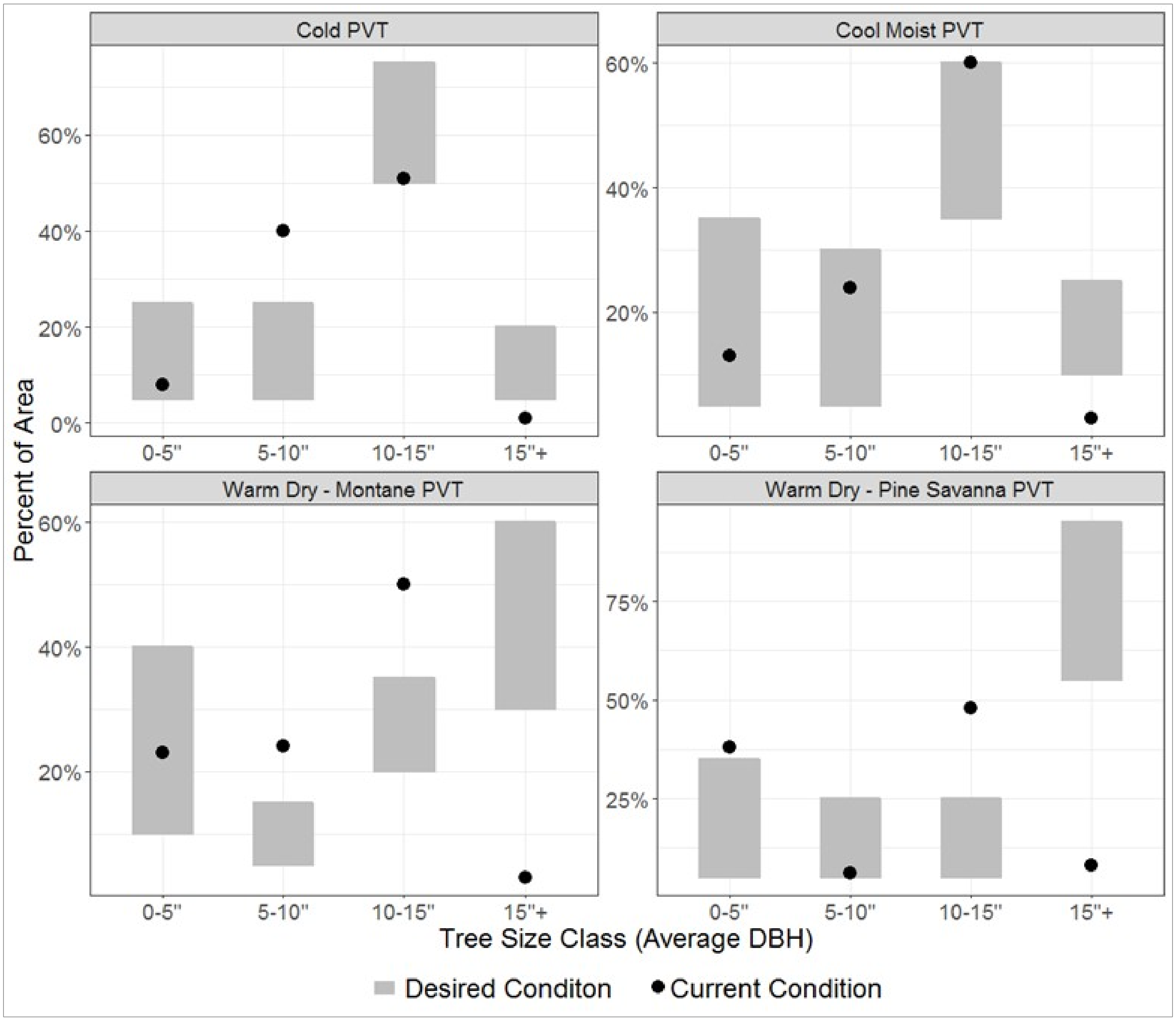

Figure 5. Current and desired conditions of forest size classes (current condition is based on VMap data)

Perhaps the most notable and consistent departure from desired conditions is the lack of large trees (over 15 inches) and the relatively higher levels of small and medium sized trees. This situation is most likely related to historic logging practices and the lack of low and mixed severity fires that historically had the effect of reducing density and thereby increasing growing space and diameter growth on residual trees. Based on forest inventory and analysis data, between 40 and 50 percent of the stands in the medium size class (10-15 inches) already have a significant component of large trees. This reflects, in part, an increasing densification within stands due to the lack of mortality from low and mixed severity fire over the past 130 years.

Individual tree growth in the forest is based on the productivity of the site, the amount of precipitation, insect and disease activity that reduces growth, individual species growth traits, and the degree of competition for light, water and nutrients. Short-lived species such as lodgepole pine generally do not get larger than the small or medium class, unless small scale natural disturbances take place or vegetative treatments occur in younger ages. These events reduce competition, which allows increased diameter growth. Longer-lived species like Douglas-fir, ponderosa pine, and whitebark pine are capable of growing to the larger size classes if open growing conditions are maintained by small disturbance events or vegetation treatments that reduce competition for growth resources (water, nutrients and light). Without disturbance, progression into larger size classes will be slow. In areas where small-scale disturbances have taken place or vegetation thinning treatments have occurred this progression may be more rapid.

Warm Dry Potential Vegetation Type – Both the montane and pine savanna portions of the Warm Dry potential vegetation type show departures in size class from the desired condition that have been widely observed for this potential vegetation type (Hessburg et al. 2005). In the Pine Savanna portion, the existing proportion of small trees (under 5 inches diameter at breast height) is above the desired condition, largely due to the recent effects of large, high severity wildfires on the Ashland Ranger District (U.S. Department of Agriculture 2014). A significant portion of this area has no surviving trees (and therefore no seed source), and is likely to remain mostly unforested, and hence in the smallest size, for several decades. This potential vegetation type is also characterized by a dearth of the largest size class and an overabundance of medium-sized trees. This is likely primarily due to the relative lack of low severity fire in recent decades leading to increasing stand density, thereby lowering the average stand diameter. Large size class forests would have been relatively open or clumpy patch mosaics (Larson and Churchill 2012, Churchill et al. 2013), with the large trees generally being long-lived and capable of surviving moderate or low severity fire when mature. Vegetation treatments that remove small diameter trees while retaining the largest trees would help decrease the overabundance of medium tree size class while simultaneously increasing the amount of the more resilient large size class.

Cool Moist Potential Vegetation Type - A wide range in proportion of seedling/sapling forest types of the Cool Moist potential vegetation type would be expected and desired, as well as a naturally lower level of large forest size class compared to the Warm Dry potential vegetation type. The abundance of the medium tree class is on the high end of the desired condition. The existing proportion of large size class is somewhat below the desired range but not to the extent as Warm Dry sites. Most of the Cool Moist potential vegetation type is in the medium size class, partly because the high productivity of the Cool Moist potential vegetation type supports high densities of trees. In the absence of an intermediate disturbance, stands can remain in the medium size class for long time periods as tree growth is reduced in higher density stands. Lodgepole pine, a significant component of this potential vegetation type is well adapted to moderate and high severity fire, and seeds in abundantly after fires. Lodgepole pine often does not reach large sizes thereby contributing to the bulge in the medium size class in this potential vegetation type. Subalpine fir and spruce also establish readily on the moist sites and persist for many decades as smaller diameter trees in shaded understory conditions, thereby bringing down average stand diameters. When high densities limit growth, only a portion of the forest in the small size class would progress into the larger size classes before the next stand-replacing disturbance. Less dense forests or forests on more productive sites would transition through the smaller size classes and into the very larger tree size class relatively quickly. In areas with large size classes, a relatively fire tolerant large diameter overstory tree layer would typically exist (Douglas-fir) atop a more dense mid and understory tree layer. Large, old Engelmann spruce and subalpine fir should occur in sheltered, moist settings.

Cold Potential Vegetation Type – In the Cold potential vegetation type, the existing proportion of the small tree size class (5-10 inches diameter at breast height) is above the desired range, and the large tree size class is below. The observed departure is in part due to the effects of densification due to the lack of intermediate disturbance (mixed severity fire) in the more productive parts of the potential vegetation type coupled with the devastating effects of blister rust and bark beetles on large white bark pine trees. Between 2004 and 2009 approximately 80 percent of large size class whitebark pine were killed by an epidemic of mountain pine beetle (Shanahan et al. 2016). See discussion on whitebark pine in At-Risk Plant Species section for more detail on the current status, threats and vulnerabilities to whitebark pine. Large subalpine fir and Engelmann spruce commonly develop in riparian areas and moist basins.

Large Tree Structure

The “large” forest size class as discussed in the previous section describes an averaged, stand-level diameter (over 15 inches average diameter at breast height). However, individual large trees often occur in stands dominated by smaller trees. In these situations, the stand may have a relatively small average diameter, but the presence of large trees provides important and unique ecological functions. For example, large diameter live trees (over 15 inches diameter at breast height), particularly long-lived fire tolerant ponderosa pine and Douglas-fir, are uniquely valuable ecologically due to their disproportionate contribution to resilience in dry and mixed mesic conifer forests (Hessburg et al. 2015). These trees can survive low to moderate fire, contributing to the recovery of the forest after disturbance, promoting resilience, and providing long-term structural diversity. Where present in sufficient numbers they contribute to late successional forest and, in some cases, old growth. They also provide important wildlife habitat, both as live trees and when they die as snags and downed wood. The decay and snag traits of these species are conducive to cavity formation and long-term snag persistence.

Large and very large trees of species other than ponderosa pine and Douglas-fir are also valuable. Large trees of intolerant species develop where frequent disturbance maintains low density, or on productive sites which provide ample moisture and nutrients for individual tree growth. For example, large Engelmann spruce and subalpine fir can be long-lived and contribute to late successional and old growth forest structures. Unlike ponderosa pine and Douglas-fir, large trees of these species tend to develop in areas protected from disturbance. Lodgepole pine only rarely reaches large sizes and is not fire tolerant. Aspen is less common on the Custer Gallatin National Forest, and is generally short-lived, but when it does reach a large size it provides unique habitat for cavity nesting wildlife. Whitebark pine and limber pine can grow to fairly large diameters, although generally short in height, to provide important structures on the harshest growing environments on the Custer Gallatin, but are limited in their occurrence.

A significant proportion of stands in smaller size classes also contain a large tree structure as defined by the minimum criteria in table 37. The criteria shown in table 37 are based on analysis of old growth found in Green et al. (2011) and indicate thresholds of ecological importance. For example, based on forest inventory and analysis data, approximately 30-40 percent of stands in the medium size class (10-15 inches average diameter at breast height) and even 7-14 percent of stands in the small size class (5-10 inches average diameter at breast height) contain large trees at a density equal to or greater than the minimum criteria for large tree structure shown in table 37. Although the mean diameter of these stands is less than 15 inches, the large component represented in these stands are critical pieces of ecosystem diversity and resilience. To address this, in addition to the amount of large size class, the distribution of large tree structure across the landscape is also considered a key ecosystem characteristic.

Table 37. Large tree structure definitions and current and desired conditions, forestwide and by broad potential vegetation group. Definitions are based on Green et al. (2011) indicating thresholds of ecological importance.

Broad Potential Vegetation Group	Large Tree Structure Minimum Criteria (at least 15 inches diameter)	Current Condition (percentage of broad potential vegetation type)[1]	Desired Condition (percentage of broad potential vegetation type)[2]
Warm Dry - Montane	At least 5 trees per acre	31 percent (24 to 39 percent)	45 to 80 percent
Warm Dry – Pine Savanna	At least 5 trees per acre	13 percent (8 to18 percent)	55 to 95 percent
Cool Moist	At least 10 trees per acre	33 percent (27 to 40 percent)	30 to 60 percent
Cold	At least 8 trees per acre	26 percent (21 to 30 percent)	45 to 80 percent

1. Existing condition shown is the mean percent of the area with the 90 percent confidence interval shown in parenthesis. Source is Region 1 Summary Database, forest inventory and analysis data
2. Desired condition is based on natural range of variability

As table 37 shows, the Warm Dry potential vegetation type is currently below the desired condition for large tree structure with the Pine Savanna portion exhibiting a particularly large departure. Reductions of large trees in the Warm Dry potential vegetation type likely occurred historically as early settler's used trees for mining timbers, railroad ties, home building and other needs. Additionally, stand replacement fires have likely reduced the prevalence of large trees in recent decades. In high-frequency, low-intensity fire regimes, fire-adapted species like ponderosa pine and Douglas-fir would be expected to survive historically typical, low-severity fires. However, with fire exclusion, stand densities, ladder fuels and crown bulk density have significantly increased in this forest type across the west (Veblen et al. 2000, Hessburg et al. 2005) and large stand replacement fires are occurring more commonly. On the pine savanna units the acreage of stand replacement fire since 1988 has increased and has resulted in mortality of large trees. Pine engraver beetle populations increase dramatically post fire on the pine savanna units. Fire damaged individual large ponderosa pine that appear to have survived the fire disturbance are commonly attacked and killed by this beetle.

In the Cold potential vegetation type, the deficit in area with large tree structure is largely attributable to the devastating combined effects of blister rust and mountain pine beetle in recent decades. The Cool Moist potential vegetation type is also below the desired condition. The decreased amount of large tree structure here is likely due to a combination of past logging practices and fire suppression that has decreased the amount of mixed severity fire that would have the effect of lowering stand density and increasing diameter growth on residual trees.

Density

Forest density is a measure of the area occupied by trees. The density of trees can influence tree growth and vigor; susceptibility to drought, insects and diseases, wildfires, and windthrow; and the rate of forest succession as well as other attributes such as vertical structure. These factors in turn affect whether the stand is suitable habitat for certain wildlife species. For this analysis, tree canopy cover is used as the measure of density. *Canopy cover* is the percentage of ground covered by a vertical projection of the outermost perimeter of the tree crowns, considering trees of all heights.

The three canopy cover classes and associated vertical structures are described in table 38. These classes only apply to lands within forested potential vegetation types.

Table 38. Forest density classes

Tree Density Class	Canopy Cover Range	Description
Low	Under 40 percent	Low and medium tree canopy cover classes represent relatively open forests with 10 to 39.9 percent canopy cover. This class is common in young forests. In addition, low densities are found in dry forest types at all stages of succession, particularly in the warm dry broad potential vegetation group, where site conditions or disturbances maintain low tree density. Cool moist or cold forests may also be in this condition particularly where impacted by disturbances such as mountain pine beetle infestations. When summarizing VMap data, transitional areas (areas recently affected by stand-replacing disturbance) are also included in this size class.
Medium	40 to 59.9 percent	The medium to high tree canopy cover class represents a more fully stocked forest, a condition which is common in more moist forests of shade tolerant species, often found on the cool moist broad potential vegetation group. Examples of forests with this density could include mature single-storied lodgepole pine or spruce/fir multistoried stands. Dry forests may also be in this density class particularly where fire has been excluded and understory layers have developed.
High	60 percent or more	The high canopy cover class includes forests with a relatively closed canopy, most often on productive sites on the cool moist broad potential vegetation group. This density class is common in stands with a spruce/fir component in a multi-storied condition. This condition also arises in single-storied lodgepole pine and sometimes Douglas-fir that regenerate to extremely high densities after fire. High tree density can limit tree growth as well as sunlight to the understory, limiting vegetation in the understory. This condition may also occur in dry forests that have missed natural fire entries and developed layers in the understory.

Canopy cover is low when the stand is in the earliest stage of succession and dominated by seedlings. As trees grow, crowns expand to fill up growing space, and canopy cover gradually increases. Growth of understory trees over time also adds to the canopy cover and vertical structure as the forest grows into the later successional stages. Disturbances and competition-based mortality can limit tree density. Site productivity also affects canopy cover, with more productive, moist sites supporting higher densities, and harsh sites with poor soils supporting lower densities. Frequent fire, particularly in the Warm Dry potential vegetation type, can maintain low canopy covers at all stages of forest succession.

Forest density influences tree species composition and vice versa. For example, ponderosa pine and lodgepole pine are intolerant of shade and cannot survive in the lower canopy layers. Shade tolerant species, such as subalpine fir and spruce can prosper in dense stand conditions with limited light. Unless a disturbance reduces competition from shade tolerant species, intolerant species will die out. Some cover types, such as lodgepole pine, naturally grow at high density. Others, such as ponderosa pine, typically grow at more open densities with natural disturbance regimes.

Maintaining appropriate amounts and spatial distribution of high-density forest is a critical component of maintaining ecological integrity as these conditions provide important cover and foraging conditions for native wildlife. However, when high-density forest is too abundant or too spatially aggregated, the resistance and resilience of large landscapes may be at risk. In general, high-density forest has a greater likelihood of supporting a fast moving intense crown fire due to greater fuel quantities and the vertical and horizontal continuity of fuels. Lower forest densities are therefore desired near communities or other values at risk from fire. In addition, as the density increases, individual tree growth slows, a deficit of soil moisture develops and trees lose their ability to withstand attacks by insects, pathogens, and parasites (Safranyik et al. 1998). Shifts towards lower-density forests would likely increase the large tree size classes and concentrations described above.

Figure 6 displays the current and desired proportions of forest density classes. An array of density classes across the landscape would contribute to desired ecological conditions. Forest density influences wildlife habitat, forest resilience, timber productivity, and fire hazard. More open densities tend to be more resilient to fire as well as insects and diseases, and promote the growth of large trees. Moderate densities tend to maximize timber production. Higher densities provide valuable wildlife habitat conditions particularly in the Cool Moist broad potential vegetation group.

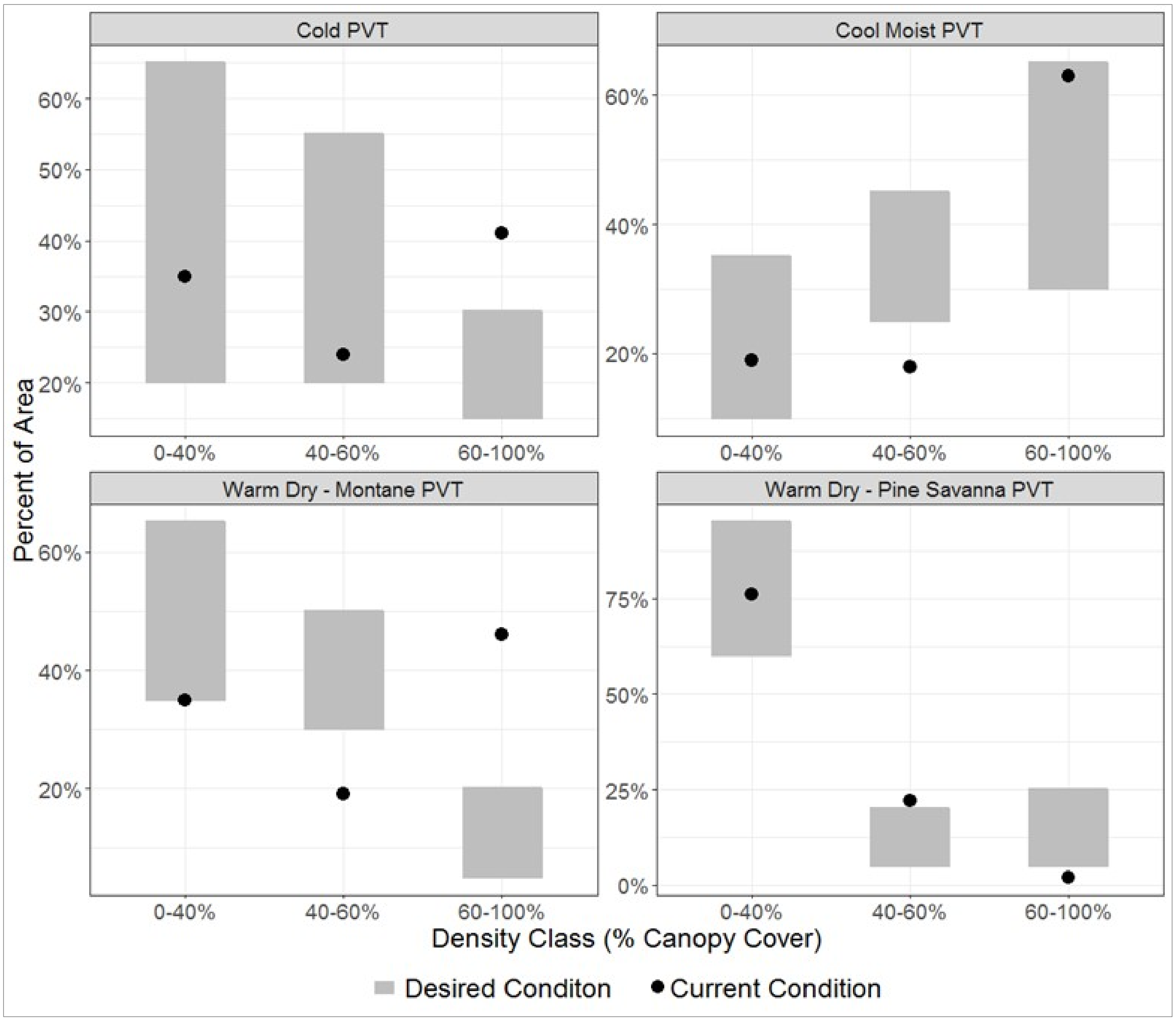

Figure 6. Current and desired conditions for forest density (current condition is based on VMap data)

Warm Dry Potential Vegetation Type – The natural range of variability analysis indicates important differences in density class distribution between the montane and pine savanna portions of the Warm Dry potential vegetation type. These differences reflect a difference in the historic fire regimes of these areas, driven by differences in productivity and species composition that would have supported higher amounts of mixed severity fire in the montane portion of this potential vegetation type. The pine savanna portion, which is composed entirely of ponderosa pine, had very high levels of low density forest, likely dominated by large trees scattered as individuals and clumps of various sizes separated by large areas of non-forested vegetation (Larson and Churchill 2012). Recent severe, large fires in this area have converted a large portion of what was high density, mature forest to low density forest in an early successional state. The departure analysis indicates that the montane portion of the Warm Dry potential vegetation type, which currently has an overabundance of high density forest, is in a condition that could support a similar trajectory.

Cool Moist Potential Vegetation Type – The Cool Moist potential vegetation type shows a lack of mid-density (40-60 percent canopy cover) structure while high density forest is as the high end of the desired range. As summarized by Hessburg et al (2016) this mixed-severity dominated fire regime was historically composed of a mosaic of forest densities where south-facing aspects were generally dominated by more open canopies maintained by frequent fires of low to mixed-severity while north-facing slopes and valley bottoms generally contained closed-canopy, multi-layered forests maintained by moderately frequent to infrequent mixed- and high severity fires. Mid-montane settings were a complex mixture of these with a variety of canopy densities depending on time-since-fire, topographic setting, and the severity of prior fires. Due to fire suppression these differences in forest density are less pronounced today, and low (largely post-disturbance) and high density forest is beginning to dominate.

Cold Potential Vegetation Type – The desired condition of forest density in the Cold potential vegetation type shows a large amount of variation in the low to mid-density classes with a relatively small promotion of the potential vegetation type to a high density state. This reflects, in part, the large amount of ecological variation in this potential vegetation type which spans from productive spruce/fir forests to whitebark pine parklands. In lower portions of this potential vegetation type, the historic ecological dynamic was likely similar to that described above for the Cool Moist potential vegetation type. Increases in high density proportions within this potential vegetation type also likely reflect, in part, encroachment of subalpine fir in to areas that were historically dominated by lower density stands of white bark pine.

Snags

Tree snags (standing dead trees) are critically important for terrestrial ecosystems. The specific ecological conditions created by high severity fire events, as well as the general level of snags and down wood are all elements of healthy, productive, and biologically diverse forests (Bull et al. 1997, Hutto 2006;2008). Numerous species depend on snags and down wood for foraging, denning, roosting, and nesting habitat. After snags fall, they also store nutrients and moisture and aid in soil development. See the Soils section for more discussion and analysis of coarse woody debris.

The general levels of snags and down wood as well as the amount of forest that has recently experienced severe fire can all affect the sustainability of particular animal or plant species. Some species are restricted in their habitat distribution to standing dead forests created by stand replacement fires (Hutto 1995). Snags are also the major source of down wood in both upland and riparian areas. Different amounts, ages, species, and sizes of snags typically exist throughout the forest landscape as a result of various disturbance agents and competition-related mortality. At any given point in time, the quantity and extent of snag habitat conditions will vary, but will be greatest following disturbance events, such as wildfire, wind events, and insect and disease outbreaks. Snags and down wood density tend to be higher in riparian areas.

A report on snag conditions in eastern Montana forests was completed by Bollenbacher and others (2008) using Forest Inventory and Analysis data. Updated data tables were produced in 2017. Medium snags are the most prevalent; relatively few large or very large are present. Large snags tend to occur in the Cool Moist broad potential vegetation group. In areas dominated by lodgepole pine, early seral stands have the most snags due to a greater proportion of stand-replacing fires and species intolerance to fire. The Warm Dry broad potential vegetation group has a more even distribution of snags into later seral stages because of a more frequent, less severe fire regime. All broad potential vegetation groups show fewer mid-seral stage snags as snags transition to downed wood. Snags occur in a clumpy manner, and in all groups the larger the snag the less common it is. This is due to: 1) fewer trees living to an old age; 2) as trees age, they grow slower, not commonly reaching large diameters; and 3) the inability of systems to contain large old trees and snags due to various types of disturbances (Bollenbacher et al. 2008).

Table 39 displays the desired and existing conditions for average snag densities. Table 40 displays the desired condition for the distribution of snags, defined as the percent of the area containing at least one snag of a given size class. A primary assumption used in the development of desired conditions for snags is that the best indication of the natural range of variability is the abundance of snags found in wilderness and Roadless areas, where natural processes have by and large been allowed to occur (Bollenbacher et al. 2008). The analysis area for snags is Forestwide by snag analysis group. Snag analysis groups are consistent with Region 1 broad potential vegetation groups, except areas dominated by lodgepole pine are addressed separately. This is important for the snag analysis because lodgepole pine is relatively short lived, generally smaller in diameter than other species, and subject to stand replacing disturbances which result in unique snag conditions and dynamics.

Table 39. Average existing and desired conditions for snag density; 90 percent confidence limit shown in parentheses. Desired condition applies at the forestwide and geographic area scales.

Snag Analysis Group[1]	Snags per Acre over 10 inches Existing[2]	Snags per Acre over 10 inches Desired[3]	Snags per Acre over 15 inches Existing[2]	Snags per Acre over 15 inches Desired[3]	Snags per Acre over 20 inches Existing[2]	Snags per Acre over 20 inches Desired[3]
Lodgepole Pine	22.4 (16.5–29)	30.7 (21.9–40.3)	3.7 (2.3–5.3)	4.2 (2.5–6.1)	0.6 (0.1–1.1)	0.8 (0.1–1.6)
Warm Dry	9.3 (6.6–12.5)	9 (3.9–15.7)	2.1 (1.3–3)	1.5 (0.3–3)	0.5 (0.1–0.9)	0 .2 (0.1–0.6)
Cold	28.4 (23.1–33.6)	27.5 (21.8–33.6)	8.2 (6.2–10.3)	7.9 (5.9–10.1)	2.1 (1.3–3)	2.1 (1.2–3)
Cool Moist	19.9 (15–25.3)	22.5 (16.9–28.7)	6.3 (4.4–8.4)	7.1 (4.9–9.5)	1.6 (0.8–2.6)	1.8 (0.8–3)

1. Snag analysis groups are from Bollenbacher (2008). As explained in Bollenbacher et al. (2008), snag analysis groups are consistent with the Region 1 Broad Potential Vegetation Types except that areas dominated by lodgepole pine are separated because it does not grow as large as other common tree species on eastside Forests, and therefore does not contribute as many large diameter snags.
2. Existing condition (with 90 percent confidence limit) comes from the Region 1 Summary Database based on forest inventory and analysis data.
3. Desired condition is also a Forestwide average and is derived from snag levels (with 90 percent confidence interval) found in predominantly unmanaged areas of the Custer Gallatin National Forest. Data source: Region 1 Summary Data Base based on forest inventory and analysis data.

Table 40. Existing and desired conditions for snags; 90 percent confidence limit shown in parentheses. Desired condition applies at the forestwide and geographic area scales.

Snag Analysis Group[1]	Percentage of area with at least one snag per acre over 10 inches Existing[2]	Percentage of area with at least one snag per acre over 10 inches Desired[3]	Percentage of area with at least one snag per acre over 15 inches Existing[2]	Percentage of area with at least one snag per acre over 15 inches Desired[3]	Percentage of area with at least one snag per acre over 20 inches Existing[2]	Percentage of area with at least one snag per acre over 20 inches Desired[3]
Lodgepole Pine	36 (29 - 43)	47 (37 - 56)	12 (8 - 17)	15 (9 - 21)	3 (1 - 5)	4 (1 - 8)
Warm Dry	20 (16 - 25)	17 (10 - 25)	8 (5 - 11)	5 (1 - 10)	3 (1 - 5)	2 (1 - 4)
Cold	43 (37 - 49)	44 (37 - 51)	23 (18 - 28)	24 (18 - 30)	9 (6 - 13)	10 (6 - 13)
Cool Moist	39 (32 - 47)	44 (36 - 52)	21 (16 - 27)	25 (18 - 32)	9 (5 - 14)	10 (5 - 16)

1. Snag analysis groups are from Bollenbacher (2008). Snag analysis groups are consistent with the Region 1 Broad Potential Vegetation Types except that areas dominated by lodgepole pine are separated.
2. Existing condition (with 90 percent confidence limit) comes from the Region 1 Summary Database based on forest inventory and analysis data.
3. Desired condition is also a Forestwide average and is derived from snag levels (with 90 percent confidence interval) found in predominantly unmanaged areas of the Custer Gallatin National Forest. Data source: Region 1 Summary Data Base based on forest inventory and analysis data.

Snag conditions at a forestwide scale are similar to what might occur under natural regimes and are generally within the natural range of variation. At smaller scales of analysis (such as project level), timber harvest and human access can have substantial impacts on snag density, distribution and longevity (Wisdom and Bate 2008). Presence of localized disturbances could also have substantial influence on snag conditions at smaller scales.

Old Growth

Old growth is distinguished by old trees and related structural attributes. Old growth encompasses the later stages of stand development that typically differ from earlier stages in a variety of characteristics which may include tree size, accumulations of large dead woody material, number of canopy layers, species composition, and ecosystem function. For the purposes of this document, old growth is defined by the criteria established for the Northern Region of the Forest Service (Green et al. 2011; table 41 through table 43). These old growth definitions are specific to forest type and habitat type group. Key attributes of old growth include age, numbers and diameter of the old tree component within the stand, and the overall stand density. Minimum thresholds have been established for these attributes. Associated characteristics are also defined for each old growth type such as probabilities of downed woody material, number of canopy layers, and number of snags over 9 inches diameter at breast height. For this analysis, old growth is estimated with Forest Inventory and Analysis plots and based on the minimum criteria found in Green et al. (2011).

For table 41, the warm and dry broad potential vegetation type for the Custer Gallatin National Forest is described as typically containing large diameter, old Douglas-fir or ponderosa pine; rare types have lodgepole or subalpine fir. A relatively open overstory canopy exists, but Douglas-fir can be dense in the mid and understory canopy layers with lack of disturbance. When this occurs, the large trees become more susceptible to bark beetle-caused mortality.

Table 41. Minimum criteria for old growth[1] and typical stand conditions for the warm and dry broad potential vegetation type[4] on the Custer Gallatin National Forest

Old Growth Type[2]	Habitat type group[3]	Minimum age of large trees	Minimum trees per acre and tree diameter	Minimum basal area (square feet per acre)
1 – Douglas-fir	A	200	4 at least 17 inches	60
2 – Douglas-fir	B, C	200	5 at least 19 inches	60
4 – ponderosa pine	A, B, C	180	4 at least 17 inches	40
5 – limber pine	A, B	120	6 at least 9 inches	50
6 – lodgepole pine	A, B, C	150	12 at least 10 inches	50
7 – Engelmann spruce and subalpine fir	C	160	12 at least 17 inches	80

1. Based on definitions found in Green et al (2011).
2. Old Growth Type - the type is a group of forest cover types that have similar characteristics relative to size, number and age of dominant overstory trees.
3. Habitat Type Group - Habitat types are grouped differently according to geographic zone. The letters identify the zone habitat type groups displayed in Appendix A of Green et al (2011). Habitat type groups are grouped into larger groups based on similarity of temperature and moisture regimes within each zone.
4. This crosswalk shows the most dominant relationship between old growth habitat type group and Region 1 broad potential vegetation type; specific habitat types may vary.

For table 42, the cool and moist broad potential vegetation type for the Custer Gallatin National Forest has Douglas-fir, Engelmann spruce, subalpine fir, or lodgepole pine as the dominant large, old trees; rare sites may have whitebark pine. Lodgepole pine may be single-storied, or support a developing understory of spruce and fir. Spruce and fir old growth is typically dense, with multi-canopy layers, with subalpine fir and spruce the most common mid and understory tree species.

Table 42. Minimum criteria for old growth[1] and typical stand conditions for the cool and moist broad potential vegetation type[4] on the Custer Gallatin National Forest

Old Growth Type[2]	Habitat type group[3]	Minimum age of large trees	Minimum trees per acre and tree diameter	Minimum basal area (square feet per acre)
2 – Douglas-fir	D, E, F, H	200	5 at least 19 inches	60
3 – Douglas-fir	G	180	10 at least 17 inches	80
6 - lodgepole pine	D, E, F, G, H	150	12 at least 10 inches	50
8 – Engelmann spruce and subalpine fir	D, E	160	7 at least 17 inches	80
9 – Engelmann spruce and subalpine fir	F, G, H	160	10 at least 13 inches	60
11 – whitebark pine	D, E, F, G, H	150	11 at least 13 inches	60

1. Based on definitions found in Green et al (2011).
2. Old Growth Type - the type is a group of forest cover types that have similar characteristics relative to size, number and age of dominant overstory trees.
3. Habitat Type Group - Habitat types are grouped differently according to geographic zone. The letters identify the zone habitat type groups displayed in Appendix A of Green et al (2011). Habitat type groups are grouped into larger groups based on similarity of temperature and moisture regimes within each zone.
4. This crosswalk shows the most dominant relationship between old growth habitat type group and Region 1 broad potential vegetation type; specific habitat types may vary.

For table 43, the cold broad potential vegetation type for the Custer Gallatin National Forest has Engelmann spruce, subalpine fir, and whitebark pine as the most common large, old overstory trees.

Because of the harsh conditions, tree growth is slower and old trees are smaller than in old growth at lower elevations. There are typically multi-canopy layers, though tree density may be low. Subalpine fir and spruce dominate the mid and lower canopy.

Table 43. Minimum criteria for old growth[1] and typical stand conditions for the cold broad potential vegetation type[4] on the Custer Gallatin National Forest

Old Growth Type[2]	Habitat type group[3]	Minimum age of large trees	Minimum trees per acre and tree diameter	Minimum basal area (square feet per acre)
6 - lodgepole pine	I	150	12 at least 10 inches	50
9 – Engelmann spruce and subalpine fir	I	160	10 at least 13 inches	60
10 – Engelmann spruce and subalpine fir	J	135	8 at least 13 inches	40
11 – whitebark pine	I	150	11 at least 13 inches	60
12 - whitebark pine	J	135	7 at least 13 inches	40

1. Based on definitions found in Green et al (2011).
2. Old Growth Type - the type is a group of forest cover types that have similar characteristics relative to size, number and age of dominant overstory trees.
3. Habitat Type Group - Habitat types are grouped differently according to geographic zone. The letters identify the zone habitat type groups displayed in Appendix A of Green et al (2011). Habitat type groups are grouped into larger groups based on similarity of temperature and moisture regimes within each zone.
4. This crosswalk shows the most dominant relationship between old growth habitat type group and Region 1 broad potential vegetation type; specific habitat types may vary.

Old growth is of particular value to many wildlife species, is an important component of biological diversity, and provides functions such as carbon storage. It also contains biological legacies and seed sources that contribute to landscape resilience. The concept of old growth involves not only the age of a forest but also characteristics such as large trees, size and spacing variation, large dead standing and fallen trees, broken and deformed tops, bole and root rot, multiple canopy layers, canopy gaps and understory patchiness, cessation in height growth of oldest trees, low net productivity, and biochemistry of secondary metabolic products in old trees (Johnson et al. 1995). This late-stage state of succession is not static and as old growth dies, it is replaced by younger forests that age. The proportion and distribution of old growth across the landscape changes naturally over time. Existing old growth is vulnerable to moderate or high severity fire, as well as insects and disease. Fire exclusion, particularly in low elevation warmer sites, has altered vegetation structure and composition in some old growth forests. In many areas, increasing tree densities and canopy layers have increased tree stress and vulnerability to mortality from insects, disease, and fire.

For this analysis, current old growth is estimated with forest inventory and analysis plots using an algorithm based on the definitions found in Green et al (2011). Forest inventory and analysis data is designed to assess forest conditions at a broad scale and cannot be used to map old growth at the stand level. Moreover, as noted by Green et al. (2011), "because of the great variation in old growth stand structures, no set of numbers can be relied upon to correctly classify every stand…do not accept or reject a stand as old growth based on the numbers alone; use the numbers as a guide." As such, field inventories are necessary to accurately identify old growth stands on the ground. However, it is infeasible to maintain a stand examination inventory that covers every acre in a large analysis area and there is no forestwide map of old growth. This type of inventory may occur at the project level, where site specific identification of old growth may be necessary. Using this methodology, figure 7 shows the amount of old growth by cover type and Northern Region Broad Potential Vegetation Types on the Custer Gallatin National Forest. There is no quantitative estimate of the natural range of variation of the abundance and distribution of old growth. It is difficult if not impossible to determine quantitatively the natural range in variation of old growth as currently defined across the landscape because the specific stand characteristics required to classify as old growth cannot be estimated with the model used (SIMPPLLE).

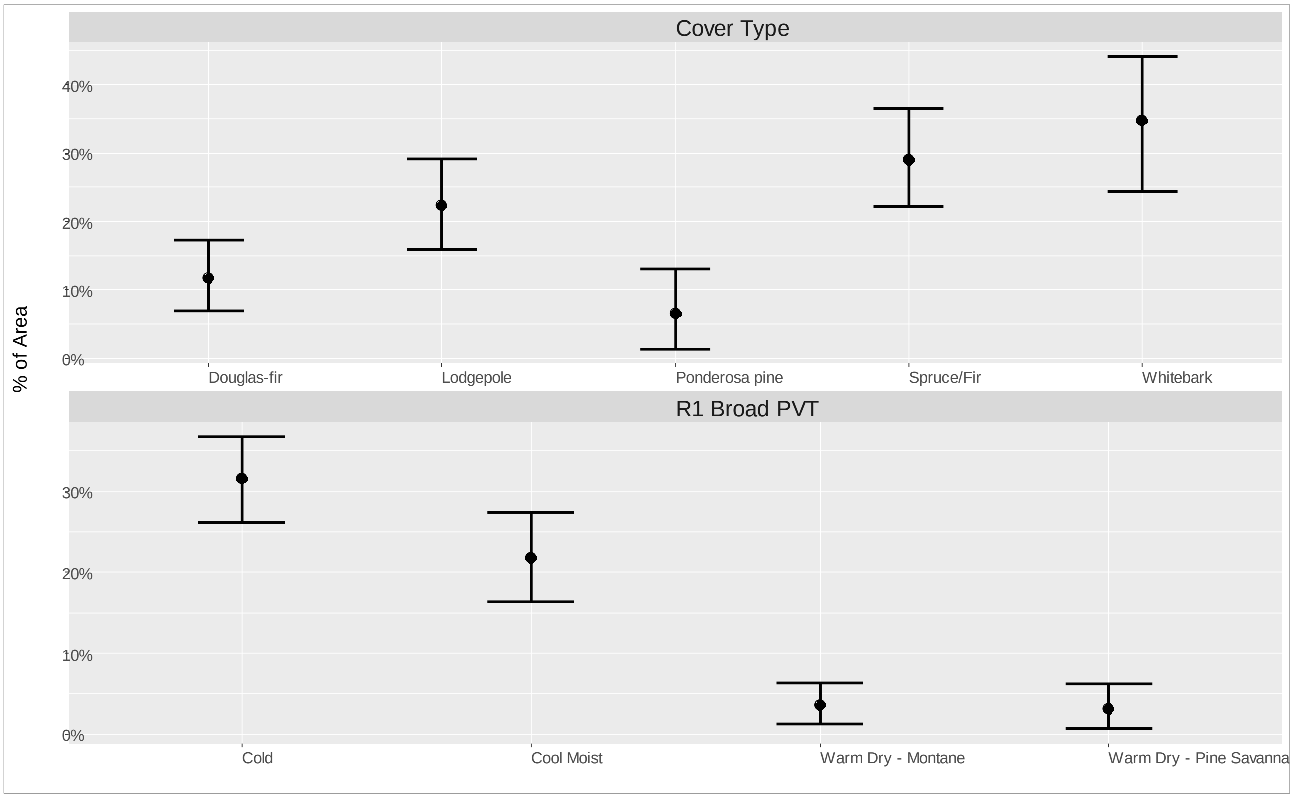

Figure 7. Current amount of old growth forest on the Custer Gallatin National Forest by cover type and Region 1 Broad potential vegetation types. Figure shows estimated mean with 90 percent confidence interval. Data from Region 1 Summary Database v 1.9.12 and based on forest inventory and analysis data.

Landscape Pattern

Historically, landscapes were shaped by disturbance regimes interacting with topography, vegetation and climate. The result was an ever-shifting mosaic of diverse vegetation and different patch sizes, shapes, and distributions. This patch mosaic is a critical element of biodiversity creating and reinforcing biological diversity in structure and function but also, just as importantly, conferring resiliency to the system as a whole (Turner et al. 2001). For example, patches created by wildland fire have strong regulating effect on future wildfire occurrence, fire size and fire severity (Harvey et al. 2016a, Parks et al. 2016b) and mountain pine beetle outbreaks are less severe in landscape with diverse age structures (Schoettle and Sniezko 2007). Negative feedbacks associated with landscape heterogeneity are necessary components of self-regulating landscapes including creating and maintaining resilience to future events (McKenzie and Kennedy 2011, Larson et al. 2013). Heterogeneous landscapes may also have more corridors, buffers, and refugia to promote connectivity for wildlife and plant migration, thereby increasing the adaptive capacity of the landscape to climate change (Halofsky et al. 2018a).

As with other key ecosystem characteristics, assessing the natural range of variability for landscape pattern can provide a useful reference condition to manage for resilient forests (Landres et al. 1999, Keane et al. 2009). To this end, an analysis of the natural range of variability was completed to characterize the patch size distribution for four categories of patch sizes (under 40 acres, 40-100 acres; 100-1,000 acres and over 1,000 acres) and three broad successional stages: early-seral (under 5 inches average diameter at breast height), mid-seral ((5-15 inches average diameter at breast height) and late-seral (over 15 inches average diameter at breast height). The analysis was stratified by potential vegetation type to account for broad differences in disturbance regimes. Table 44 shows the desired condition and current status for patch size distribution based on this analysis.

The patch distribution analysis revealed three notable areas of departure. First, large patches (over 1,000 acres) of mid-seral forest (5-15 inches average diameter at breast height) are dramatically overrepresented across the Custer Gallatin National Forest. This is likely due to natural succession in the absence of intermediate disturbance events trending the national forest towards a generally more homogenous landscape composed of larger patches of mid successional forest. Second, patches of late-seral forest (over 15 inches average diameter at breast height) are underrepresented for all patch sizes. This reflects both the general effect of fire exclusion leading to densification in smaller size classes (thereby reducing the average stand diameter) as well as the significant effects of recent severe wildfires in ponderosa pine ecosystems and the combined effects of white pine blister rust and mountain pine beetle in whitebark pine ecosystems. Finally, large patches of early-seral forest (under 5 inches average diameter at breast height) are over represented in the warm dry potential vegetation type, likely due to recent large, severe wildfires in these areas.

Table 44. Desired condition and current status for patch size distribution

Region 1 Broad potential vegetation type	Patch Size (Acres)	Early-Seral Current Condition[1] (0-5 inches diameter[2]): (percentage of potential vegetation type)	Early-Seral Desired Condition (0-5 inches diameter[2]): (percentage of potential vegetation type)	Mid-Seral Current Condition[1] (5-15 inches diameter[2]): (percentage of potential vegetation type)	Mid-Seral Desired Condition (5-15 inches diameter[2]): (percentage of potential vegetation type)	Late-Seral Current Condition[1] (over 15 inches diameter[2]): (percentage of potential vegetation type)	Late-Seral Desired Condition (over 15 inches diameter[2]): (percentage of potential vegetation type)
Cold	under 40	5 %	3 - 6 %	10 %	11 - 16 %	1 %	11 - 14 %
Cold	40-100	1 %	1 - 2 %	5 %	4 - 8 %	0 %	4 - 6 %
Cold	100-500	2 %	1 - 5 %	11 %	6 - 14 %	0 %	7 - 11 %
Cold	500-1,000	1 %	0 - 2 %	5 %	2 - 6 %	0 %	3 - 6 %
Cold	over 1,000	1 %	0 - 8 %	59 %	3 - 16 %	0 %	8 - 32 %
Cool Moist	under 40	6 %	5 - 11 %	13 %	11 - 14 %	2 %	12 - 15 %
Cool Moist	40-100	2 %	1 - 4 %	8 %	4 - 6 %	1 %	4 - 5 %
Cool Moist	100-500	3 %	1 - 6 %	14 %	6 - 10 %	1 %	6 - 9 %
Cool Moist	500-1,000	1 %	0 - 2 %	6 %	2 - 5 %	0 %	2 - 4 %
Cool Moist	over 1,000	5 %	0 - 8 %	39 %	4 - 15 %	0 %	8 - 19 %
Warm Dry - Montane	under 40	7 %	7 - 15 %	14 %	10 - 16 %	3 %	19 - 23 %
Warm Dry - Montane	40-100	2 %	2 - 4 %	7 %	2 - 4 %	1 %	6 - 9 %
Warm Dry - Montane	100-500	2 %	3 - 6 %	13 %	2 - 5 %	1 %	7 - 15 %
Warm Dry - Montane	500-1,000	1 %	1 - 3 %	5 %	0 - 2 %	0 %	2 - 6 %
Warm Dry - Montane	over 1,000	10 %	1 - 10 %	36 %	0 - 4 %	0 %	4 - 23 %
Warm Dry - Pine Savanna	under 40	5 %	1 - 11 %	8 %	0 - 9 %	3 %	5 - 6 %
Warm Dry - Pine Savanna	40-100	2 %	0 - 1 %	4 %	0 - 2 %	1 %	2 - 3 %
Warm Dry - Pine Savanna	100-500	4 %	0 - 4 %	7 %	0 - 5 %	1 %	4 - 7 %
Warm Dry - Pine Savanna	500-1,000	3 %	0- 3 %	4 %	0 - 3 %	1 %	2 - 4 %
Warm Dry - Pine Savanna	over 1,000	24 %	0 - 20 %	32 %	0 - 21 %	1 %	35 - 76 %

1. Existing condition shown is the mean percent of the area. Source is Region 1 Summary Database, forest inventory and analysis data
2. Diameter is diameter at breast height or DBH

3.6.3 Environmental Consequences

Quantitative assessments of ecological effects presented below are the result of models, which, by necessity, simplify very complex and dynamic relationships among ecosystem processes (such as fire and succession), topography, climate and vegetation. The models use a given set of assumptions, including the amount of stand-replacing fire, insect or disease activity, and the rate of tree growth and stand structure change over time (succession). These assumptions are based on analysis and corroboration of actual data (such as fire history and historical vegetation information) and review of scientific literature, as well as professional judgement and experience of resource specialists familiar with the ecosystems and forest types of the Custer Gallatin (see appendix B for details on model assumptions). Though best available information and knowledge is used to build these models, there is a high degree of variability and uncertainty associated with the results because of the ecological complexity and inability to accurately predict timing and location of future events. The actual timing, magnitude and location of future disturbances, such as fire or bark beetle activity, will certainly differ from that modeled, resulting in different effects to vegetation. As such, results are most appropriately used to compare *relative* differences among alternatives and general trends in vegetation but are *not* intended to be interpreted as precise values.

All Alternatives

Management Direction under the Current Plans

Vegetative Diversity. Under the plan direction in the current 1986 and 1987 forest plans, as amended, forest lands and other vegetative communities such as grassland, aspen, willow, sagebrush, and whitebark pine will be managed by wildland fire and other methods to produce and maintain the desired vegetative conditions. The current plans do not contain explicit or quantitative desired conditions for ecological diversity, but do provide more general direction to manage for vegetation composition, structures and patterns that would be expected to occur under natural succession and disturbance regimes and providing for long-term recruitment of forest structural elements such as snags and downed wood. The current plans require leaving 20-30 snags per acre after harvest. Current forest plans have no direction for retaining large trees but the 1987 Gallatin Plan has a standard, added as an amendment, to maintain a minimum of ten percent old growth forest on lands classified as forested at the mountain range scale. The current plan does not distinguish between old growth forest types. The 1986 Custer Plan has a standard to maintain sufficient old growth to support minimum viable populations of old growth dependent species.

Woody Draws. The 1987 Gallatin Forest Plan has no direction for woody draws since the habitat does not occur there. Use of wildland fire in and near woody draws can be conducted to maintain or enhance the unique value associated within riparian zones, as well as a variety of successional vegetative stages.

Under the 1986 Custer National Forest Plan, the goal for woody draws is to provide healthy, self-perpetuating riparian plant communities with diverse understory and overstory vegetation.

Woody draws are to be identified and mitigation implemented to retain unique values during project level allotment management planning for permitted livestock grazing. Management practices such as fencing, grazing deferment, burning or planting may be tried on selected areas to determine their effectiveness in maintaining or improving green ash woodland conditions. Large-scale fencing efforts to protect these areas are generally not practical. Structural range improvements will be located to attract livestock out of this management area. Nonstructural range improvements will be done only to improve diversity of habitats or implement practices designed to restore the desired vegetative composition.

Riparian. Both the 1986 Custer and Gallatin Forest Plans have related goals for riparian areas; to provide healthy, self-perpetuating riparian plant communities with diverse understory and overstory vegetation. Riparian vegetation, including shrub and overstory tree cover, is to be managed along all perennial streams with defined channels to provide shade, to maintain streambank stability and in-stream cover, and to promote filtering of overland flows. Riparian areas are critical for the maintenance of water quality and deciduous trees and shrubs that provide valuable wildlife habitats. Direction includes managing for water quality, diverse vegetation, and key wildlife habitat in these areas from conflicting uses. Uses and activities that could adversely impact these areas are to be mitigated.

Mitigation is to be implemented to retain unique riparian values during project level allotment management planning for permitted livestock grazing. Management practices such as fencing, grazing deferment, burning or planting may be tried on selected areas to determine their effectiveness in maintaining or improving the riparian zone conditions. Large scale fencing efforts to protect riparian areas are generally not practical. Structural range improvements will be located to attract livestock out of this management area.

Forest Plan direction for timber harvest activities in or near riparian zones includes management prescriptions that will meet needs of riparian zone-dependent species, provide snag recruitment to create pools, enhance spawning gravels for fish habitat, emphasize special logging practices which minimize soil disturbance, and perform directional felling of timber where needed to protect the stream or associated riparian vegetation. Trees or products are not to be hauled or yarded across stream courses unless fully suspended or when designated crossings are used and machine piling is not allowed. Equipment use or time of the activity which causes excessive soil compaction and displacement is to be avoided.

Extraction of saleable mineral materials is not allowed in riparian areas. Surface occupancy for oil and gas exploration and development are not to be permitted in 100-year floodplains or within 500 feet of the high water mark.

Use of wildland fire in and near riparian zones can be conducted to maintain or enhance the unique value associated within riparian zones, as well as a variety of successional vegetative stages.

Grasslands and Shrublands. The current forest plans call for managing these lands for good condition. For the mixed grass pine savanna ecosystem, this has often been described as providing for a diversity of warm- and cool-season graminoid and forb species and structure that includes tall (for example: big blue stem, pine savanna cord grass, pine savanna sand reed), medium (for example western wheat grass, green needle grass, needle and thread, Idaho fescue) and short grass (for example blue grama, June grass, sun sedge thread leaf sedge) species associated with mixed grass pine savanna communities.

For shrublands, it has often been described as providing a diversity of shrub communities (that is, Wyoming big sagebrush, silver sagebrush, buffalo berry, chokecherry). For mountain grassland ecosystems, this has often been described as providing a diversity of cool-season graminoid and forb species (that is, bluebunch wheatgrass, Idaho fescue, mountain brome, and western needlegrass). For mountain shrublands it has often been described as providing a diversity of shrub communities (that is, mountain big sagebrush, Wyoming big sagebrush, and ninebark).

Noxious weeds are to be reduced and communities should exhibit or be progressing toward a healthy, productive, diverse population of native and or desirable plant species, and functioning disturbance processes appropriate to the ecological site capability.

Conifer Encroachment. Under the Custer Forest Plan, conifer encroachment control may occur where (1) Silvicultural prescription indicates the need, (2) Conifer species exist on sites capable of producing less than 20 cubic feet per acre that are invading rangeland habitat types may be removed in order to maintain the acreage of primary and secondary range. An assessment of wildlife values is required as part of the analysis for any control program, (3) Conifer species existing on sites producing more than 20 cubic feet per acre if the area has been managed as rangeland for some time and the long-term objective is to manage for rangeland; and (4) In rangelands where the invading trees are less than 3-feet high, wildland fire may be the preferred treatment. Mechanical methods may be used in areas where trees are over 3-feet high, including removal for Christmas tree purposes.

Management Direction under the Revised Plan Alternatives

All the revised plan alternatives contain the same desired conditions for forested composition (dominance type and species presence), structure (size class, large tree structure, density and snags) and landscape pattern (patch size distribution). These alternatives also contain direction as to the desired role that ecological processes such as insects and fire (both wildland fire and natural, unplanned ignitions) would have in affecting forest composition and structure. Forested desired conditions are designed to maintain and enhance ecological integrity, diversity, function, and resiliency while contributing to social and economic sustainability as required by the 2012 Planning Rule. Forested desired conditions are based on an analysis of the natural range of variation for key ecosystem characteristics, which provides an understanding of how ecosystems change over time in a manner that is resilient to perturbations and disturbance. These alternatives also have the same forestwide standards and guidelines designed to move vegetation towards desired conditions. For example, all the revised plan alternatives share guidelines that provide protection and management emphasis for snags, large tree structure and old growth.

Objectives and suitability of lands for timber harvest are the primary factors distinguishing management direction among the revised plan alternatives. Objectives for the revised plan alternatives are outlined in table 9 of chapter 2 and key differences in suitability are described in table 2 of chapter 2.

Detailed desired conditions are described for grasslands, shrublands, juniper woodlands, deciduous woodlands, riparian/wetlands, alpine, and sparsely vegetated broad potential vegetation types. Guidelines are designed to protect these vegetation communities and move vegetation towards desired conditions. Further, riparian management zones are delineated around streams and waterbodies, with standards and guidelines to protect riparian areas.

Effects of All Alternatives

Ecosystem Function

In contrast to the current forest plans, all revised plan alternatives include specific plan components related to ecological processes and disturbance including insects and fire. This direction is expected to meaningfully contribute to the restoration and maintenance of biodiversity and ecological integrity of the Custer Gallatin. The current forest plans recognize the importance of maintaining natural processes and ecosystem diversity in general but do not explicitly describe desired conditions for the processes that support this diversity. Compared to the current forest plans, direction for the revised plan alternatives provides substantially more detail and clarity as to the desired extent, frequency and severity of ecosystem processes which, in turn, drive ecological structure and composition.

Landscape simulation modeling was used to assess trends in forested vegetation characteristics over time. Fire, insects, disease, and vegetation management activities are the primary disturbances that impact vegetation change. These processes interact with climate and vegetative succession to modify ecosystem composition, structure and function over time. Modeling disturbances and vegetation treatments over the next five decades – the period used for assessing effects to forested vegetation – revealed no major differences among alternatives relative to the prevalence or effects of these disturbance processes (figure 8).

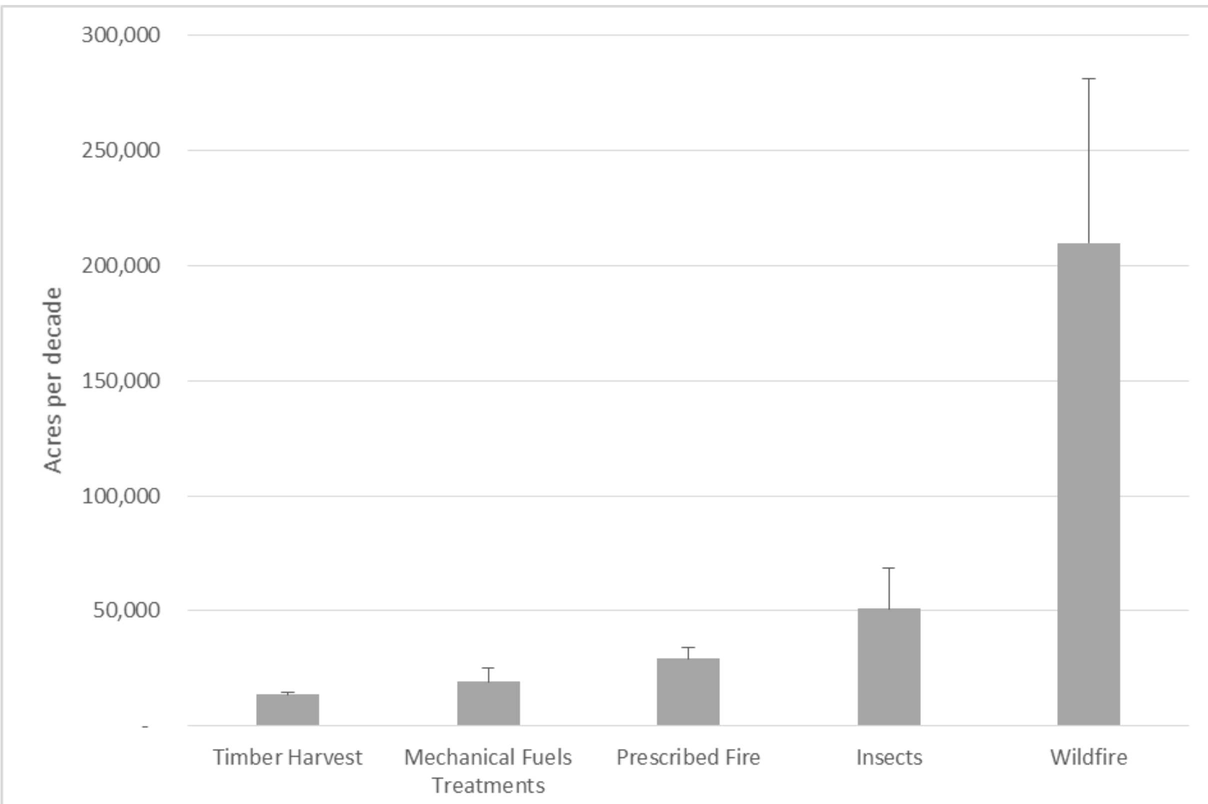

Figure 8. Projected area of forested ecosystems affected per decade by harvest, mechanical fuel treatments, prescribed fire, insects (primarily spruce budworm and bark beetles), and wildfire on the Custer Gallatin National Forest. Because there is relatively little variability across alternatives, figure shows averages (plus 1 SD) across all alternatives over a five decade period. Source: PRISM model for treatment activity; SIMPPLLE model for wildfire and insect activity.

Although the total number of acres treated through vegetation management actions (such as, timber harvest, prescribed burning, etc.) varies by alternative from a low of approximately 50,000 acres per decade in alternative E to a high of 80,000 acres per decade in alternative D, this only represents a difference of treating approximately 3 versus 4 percent of the forested landscape per decade respectively. Based on landscape dynamic simulation models, a minimum of 30-50 percent of the landscape must be treated to significantly change landscape dynamics (Keane 2018). As such, at the forestwide scale, the extent, frequency and severity of ecosystem processes and disturbances are not predicted to vary significantly across alternatives as a function of management actions. It is important to note, however, at a project scale, treatment of 30-50 percent of a project area is possible and would be expected to have an impact locally.

Fire (Wildfire and Prescribed Fire)

Wildfire

Of all disturbance agents, wildfires are expected to be the most significant factor influencing ecological structure, function and processes over the coming decades. Although it is not possible to predict exactly where and when fires will occur, there is an emerging scientific consensus that the total number of acres burned by wildfire will increase in coming decades (Spracklen et al. 2009). This analysis assumed that wildfire would approximately double in coming decades relative to the previous 30 years (see appendix B for further information on scientific basis for this assumption). This equates to approximately 375,000 acres forestwide including 200,000 to 250,000 acres per decade of wildfire in forested areas including low, mixed and high severity. Though the best understanding of behavior and effects were used to inform the model, there is an inherent degree of uncertainty. One cannot predict with high accuracy where and when fires will occur. There is also a high degree of variability, both spatially and over time, in the amount and location of wildfire. See the Fire and Fuels section for a more detailed discussion on the environmental consequences of wild and prescribed fire.

Under all alternatives, fire will continue to support the diversity of vegetation across grasslands, retard conifer encroachment into meadows and parks, regenerate aspen and green ash stands and maintain the mixture of vegetation on shrublands that help support wildlife habitat diversity. Fire exclusion will likely continue to alter successional processes, generally to favor shade-tolerant species, although vegetation treatments and wildfires may mitigate this influence somewhat. The exact timing, location and severity of future fires is impossible to predict but will have important effects on terrestrial vegetation – these effects will be the same across all alternatives.

With the projected warming trends and projected increase in wildfire under all alternatives there could be loss of greater sage-grouse priority and/or general habitats on the Custer Gallatin. Many of the other shrubs on the Custer Gallatin have sprouting capability and can recover from wildfire if browse pressure from both wild and domestic ungulates is not substantial within the first decade of recovery.

Prescribed Fire

Prescribed fire treatments are a planned fire ignition used to meet a variety of vegetation-related resource objectives, including: to improve wildlife habitat, stimulate shrub sprouting, reduce stand densities, reduce forest fuels (downed wood), create openings early successional habitat, and to restore natural disturbance processes. Prescribed fires may be designed to be of low severity (less than 40 percent tree mortality) or high severity (greater than 70 percent tree mortality), depending on the desired post-fire vegetation conditions. Across all five decades analyzed, acres of prescribed fire per decade scheduled by PRISM varies from an average of 24,000 acres per decade in alternative E to 38,000 acres per decade in alternative D. This represents a difference of less than one percent of the forested landscape and would not lead to meaningful ecological differences among alternatives at the forestwide scale. Here again, higher levels of treatment could have an important effect at more local scales.

Plan components in all the revised plan alternatives direct that there be no net loss in greater sage-grouse priority and general habitats on the Custer Gallatin. As such, there should be no effects to this habitat from prescribed fire.

Insects

Insects such as spruce budworm and bark beetles are powerful agents of change in forest ecosystems and will continue play a role in the future. The amount of insect and disease disturbance in forests is closely tied to the abundance of the host species, vegetative succession of forests into susceptible conditions (for example, larger trees, and higher densities), warmer climates and droughts. At the landscape level they influence forest regeneration, and at the stand level they kill mature trees, creating gaps and forest openings that are beneficial to wildlife. They also cause overall increases in forest and stand resiliency by promoting variability in sizes and ages of trees and in species compositions. At endemic levels, the ecological consequences are normally beneficial to forest ecosystems (Progar et al. 2007) though impacts can be detrimental to timber values. There is no difference among alternatives in terms of the predicted scale and frequency of major forest insects.

Grasshoppers and Mormon crickets are always present in any given year, but populations change in terms of relative abundance on the landscape. Under all alternatives, natural outbreaks have been known to occur and can be exacerbated by drought. Grasshopper and Mormon cricket outbreaks can have severe economic impacts on the grazing industry, especially during periods of drought when available forage is already scarce (Hewitt and Onsager 1983). In general, since most insect infestations are short-lived (a year or maybe two in the same area), the effects on rangeland vegetation are a defoliation (partial or complete) of the current year’s plant growth, but vegetative community succession is seldom affected.

Harvest

Table 45 displays the annual average acres of timber harvest scheduled by PRISM (averaged over five decades). See table 34 for a description of harvest types. See the Timber section of this environmental impact statement (section 3.15) for further discussion of the environmental consequences of timber harvest. Effects of harvest on other key ecosystem characteristics (such as, size class and forest density) are discussed below. Additional information on the PRISM model and associated assumptions can be found in appendix B.

Table 45. Average annual acres of timber harvest by alternative

Harvest Type	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Intermediate and Uneven-aged	965	967	958	839	699
Even-aged Regeneration	495	469	465	333	597

Alternative A represents the current plans' future projections if kept

Across all revised plan alternatives, desired conditions, standards and guidelines limiting timber harvest activities are the same but there are some important differences in the absolute amounts and projected ratios of treatment types across alternatives that are consistent with the theme and design of each alternative (table 45). For example, the amount of regeneration harvest in the current plans, and alternatives B and C are similar to each other and are between alternative D, which would use the least amount of regeneration harvest, and alternative E, which would use the most. The projected harvest acres shown in table 45 and produced by the PRISM model are incorporated into the SIMPPLLE model, and therefore their influence on the indicators for terrestrial vegetation are reflected in the results shown in this report.

Regeneration harvest would alter forest size class, primarily resulting in seedling/sapling forests. Reforestation (planting or natural regeneration) would occur in these stands, and can be used to achieve desired conversions in composition. In contrast to the current plans, maximum opening size limits in the revised plan alternatives have been designed to mimic the average size of natural openings and are expected to contribute to the desired patch size distribution. Other harvests such as precommercial thinning and intermediate treatments primarily reduce tree density but may also change forest composition towards desired conditions or increase average stand diameter when smaller trees are removed. Alternative D has the least amount of land that would be suitable to use timber harvest as a management tool while the current plans and alternatives B, C, and E are relatively similar (table 2). As noted above, the effect of timber harvest on forest vegetation is expected to be small relative natural disturbance agents. Nevertheless, for all the revised plan alternatives, plan components assure timber harvests are designed to help meet desired vegetation conditions. As such, for the revised plan alternatives, timber harvest is expected to contribute to achieving more resilient conditions across the Forest.

Invasive Plant Species

Noxious and other invasive weeds have the potential to substantially outcompete native vegetation and forage when left unchecked. Impacts are similar among all alternatives except alternative E which has a lower treatment objective than has traditionally been funded. In general, increased ground disturbance corresponds with increased weed spread. Roads, trails, livestock, and canopy reduction can provide ideal pathways for the introduction of exotic and non-native species. Invasive plant species can displace at-risk and other native species through competitive displacement. Competition from invasive non-native species and noxious weeds can result in the loss of habitat, loss of native pollinators, and decreased at-risk plant species viability. Impacts include herbicide spraying and mechanical ground disturbance to control noxious weeds once they gain a foothold.

Noxious weed management would continue under direction of both the Gallatin National Forest Weed Environmental Impact Statement (2005) and the Custer National Forest Weed Environmental Impact Statement (2006), until revised. Any subsequent National Environmental Policy Act decisions would continue to provide direction. Infestation levels of invasive plants would likely remain steady to slightly increasing over time. The rate of increase would be higher under alternative E than the other alternatives due to lower weed treatment objectives. Some weed species may contract in range and density as new treatment and biological options become available, while other weeds will expand in range and density.

As a result of these plan components, all ecosystems are expected to benefit from the reduction of invasive plant species, particularly in wetland-riparian, ponderosa pine and Douglas-fir open understories, and grasslands-shrublands. The revised plan alternatives provide similar protections and guidelines for invasive species treatment as the existing plan, however the plan objective for weed treatments is lowest in alternative E. Threats to native vegetation from weeds would be greatest in alternative E and less so in the current plans and alternatives B, C, and D based on treatment objectives by alternative.

Pollinators

Pollinators are crucial components of functioning ecosystems. There is evidence that many invertebrate species may be in decline due to a variety of factors, which in turn could affect native plant community pollination. Broadly, the desired conditions in the revised plan alternatives increase habitat quality for invertebrate pollinator species and decrease threats with the revised plan components. All alternatives provide habitat for pollinator species on the Custer Gallatin with native plant species, a variety of habitats, and large areas without the habitat fragmentation that has become characteristic of agricultural and developed land. All the revised plan alternatives include vegetation management plan components specific to pollinators that supports pollinator habitat treatments such as removing encroaching conifers from meadows and grasslands. Those components, in addition to the plan components for other resources that improve habitat for pollinators on the Custer Gallatin, do more to improve habitat quality under the revised plan alternatives than under the current plans. A landscape composed of a mosaic of early to late successional stands, abundant and diverse flowering plants available at all times of years, and a variety of standing or downed dead wood, bare ground, and overgrown vegetation are all hallmarks of rich heterogeneous pollinator habitat with available nesting habitat (Gilgert and Vaughan 2011) that provide overall habitat for pollinator species. The plan components for each revised plan alternative would allow for management options to increase resiliency and improve pollinator habitat on the Custer Gallatin. Draft revised plan appendix A, Management Strategies, provides best management practices considerations for pollinator habitat.

Areas proposed under the revised plan alternatives as additional recommended wilderness or backcountry areas that were not previously identified under the current plans would see a reduction in threats from ground disturbance and development, and would be managed allowing natural fire regimes to contribute as much as possible to a mosaic of different seral stages and diversity of habitats.

Timber harvest increases some short-term threats to pollinators due to a higher potential for harvest-related ground disturbance, but also can create a mosaic pattern on a landscape, open understories, and promote early successional stands with some treatments, such as regeneration harvest. Vegetation projects can also provide opportunities to improve pollinator habitat; increasing local habitat diversity by using a variety of vegetation treatment types and providing early successional habitats (such as, wildland fire, shelter wood treatment, etc.). Vegetation treatments can also increase forest resiliency by treating insects and disease, and reducing fuel loads; improving forest health in the long term. Pollinator nest sites and food sources could be impacted in the short term by mechanized equipment and incidental damage from felling trees. Site disturbance and increased weeds could also negatively impact pollinator forage and habitat requirements. Long-term habitat improvements in general include habitat heterogeneity, increased diversity and increased available forage.

Herbivory

For the foreseeable future, management under any of the alternatives would continue to provide forage production and productive livestock grazing. Acres available for livestock grazing and animal unit months for active and vacant allotments would be the same under the current plans and alternatives B and C; and animal unit months under alternatives D and E would be at current levels on active allotments only. None of the alternatives change existing allotment management since those decisions are made at the allotment level. A plan component, however, does limit livestock use based on end of season stubble height of hydrophilic plants along the greenline of low gradient alluvial streams, which is expected to maintain or improve riparian and channel morphology conditions. No active allotments or portions of active allotments are proposed to be formally closed to grazing due to other resource needs. Under all alternatives, changes to livestock management and allowable forage use levels at the site-specific scale would be made during allotment management plan revision. Furthermore, there are resource mitigations and best management practices that are part of allotment plans designed to protect or mitigate forest resources from potential disturbances by livestock grazing. These elements are site-specific for each allotment and not part of this analysis.

Plan components emphasis on improving riparian-wetland and woody draw conditions is expected to continue under all alternatives. Revisions of allotment management plans would continue to implement best management practices and implement end of season allowable use levels that are expected to move riparian areas towards desired conditions. As a result, monitoring and management adjustments may reduce permitted animal unit months for some permittees. Vacant grazing allotments would most likely be used as forage reserves for allotments affected by fire, depredation, threatened and endangered species, or riparian management issues; or they may be closed for conservation or economic considerations. It is unlikely that permitted animal unit months would be increased through the opening of new allotments under any alternative.

There is potential for further grazing pressure in the north and west bison tolerance zones on the Gardiner and Hebgen Lake Districts that could affect grazing permit holders, necessitating special timing or non-use for resource protection considerations. The potential for this would be greater under alternatives B, C and D since plan components direct that management actions taken to resolve bison-livestock conflicts should favor bison within the tolerance zones.

All revised plan alternatives favor beaver activity. Effects from beaver activity can reverse or hasten the succession of plant communities while improving watershed conditions. When beaver selectively cut down certain tree species and create sunlit gaps in the forest, species of sun-loving, shade-intolerant plants often regenerate there, converting a mid-successional stand to an early successional stand, although sometimes they release understory conifers and thus hasten succession (Naiman et al. 1988, Johnston and Naiman 1990, Pastor and Naiman 1992).

Composition

Coniferous Forest

All the revised plan alternatives include specific plan components related to vegetation composition that will contribute to biodiversity and ecological integrity of the Custer Gallatin. Compared to the current forest plans, which do not explicitly describe desired conditions for forested vegetation composition, this direction provides substantially more detail and clarity as to vegetation conditions and species compositions management.

As discussed in the affected environment, most of the major coniferous species in the Custer Gallatin National Forest are within the desired ranges for both species presence (the distribution of individual species) and dominance (the distribution where a given species is the most common within a stand). This includes Douglas-fir, lodgepole pine, subalpine fir and Engelmann spruce. Model results indicate that these species will be maintained within their desired range over the next five decades and the trend is the same across all alternatives (figure 9).

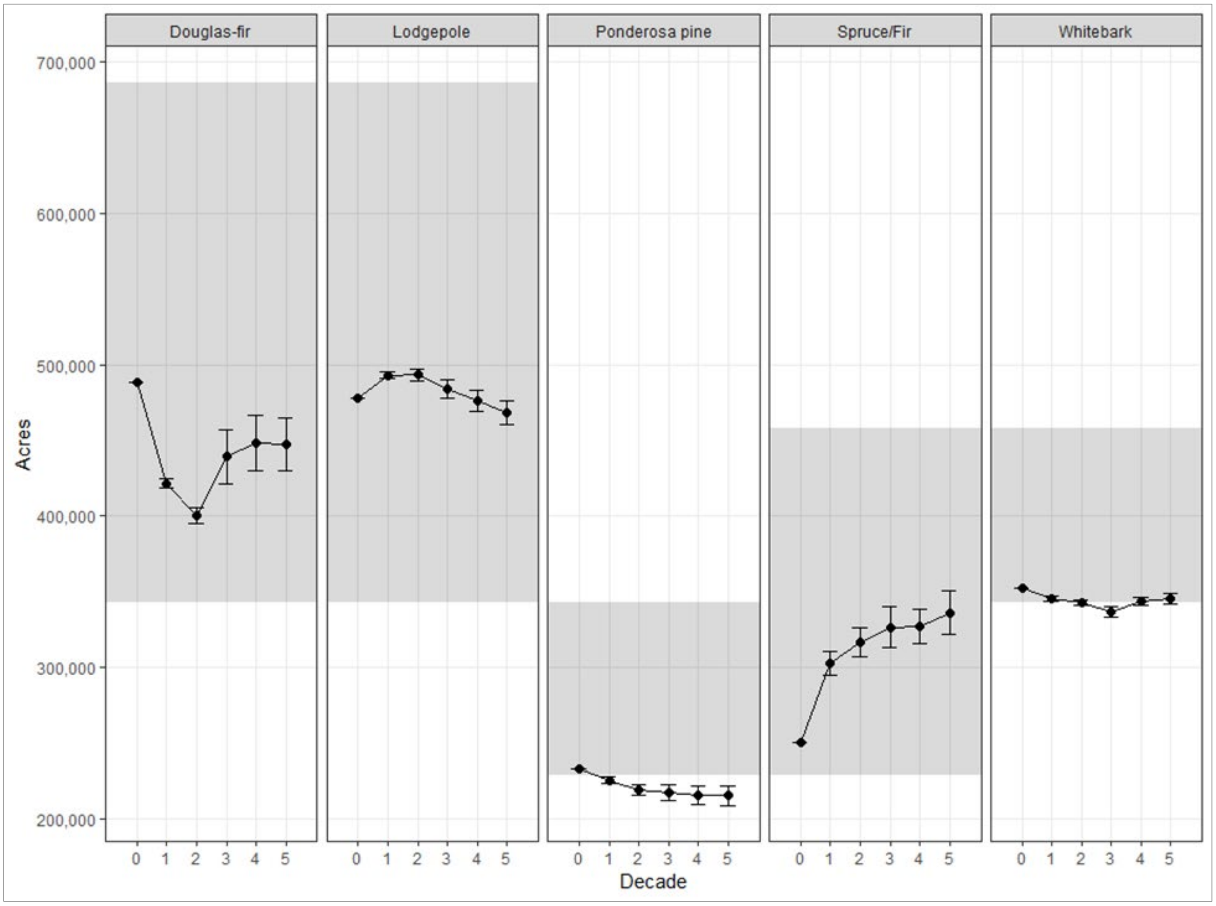

Figure 9. Change in species dominance over time. Shaded area indicates the desired condition. Because there was little variability among alternatives, figure shows averages across all alternatives (plus one SD).

Whitebark pine is currently at the low end for both species dominance and distribution. Although model results indicate relatively little change over the coming decades, there remains a high degree of uncertainty about the future of whitebark on the Custer Gallatin National Forest. As reviewed in Hansen et al. (2018), both climate suitability models and mechanistic models project substantial reductions in area of suitable habitat and loss of larger size classes. Moreover, in association with warming temperatures, bark beetle outbreaks are projected to increase in future decades and blister rust is also expected to inflict increased mortality on whitebark pine under a warming climate. However, restoration actions such as planting rust-resistant seedlings and employing other strategies such as protection from mountain pine beetle and thinning treatments to reduce completion and fire intensity may help mitigate the negative effects of climate change (Keane et al. 2017, Ireland et al. 2018). In addition, a number of efforts are underway that will incorporate both macro and micro-refugia sites which can improve the efficacy of restoration efforts by taking into consideration climate and site characteristic (for example, aspect, soils, slope, elevation) interactions at specific locations on the ground to improve tree survival (resilience and persistence). See At-Risk Plants section for further discussion of whitebark pine.

Model results also predict a slight downward trend in presence and dominance for ponderosa pine in all alternatives. Here again, the actual trend in ponderosa pine is somewhat hard to predict and will depend on the balance between the species ability to expand into previously occupied habitat, where it has been reduced by large, severe wildfires, and the potential for future wildfire to further reduce its distribution.

Dry forests, such as these that already occur at the edge of their climatic tolerance, are increasingly prone to conversion to non-forests after wildfires due to regeneration failure (Stevens-Rumann et al. 2018). This trend is likely to continue in the future as suitable climate space for tree regeneration becomes increasingly rare (Bell et al. 2014).

Mesic Deciduous Woodlands

All the revised plan alternatives include specific plan components related to vegetation composition that will contribute to biodiversity and ecological integrity of mesic deciduous woodlands. Compared to the current forest plans, which do not explicitly describe desired conditions for mesic deciduous woodlands, this direction provides more detail as to what vegetation conditions and species composition to maintain or move toward.

Under all alternatives, climate conditions influence effects to mesic deciduous woodlands. The northwestern Great Plains semi-arid environment is marginal for tree growth, and green ash is at the western, most arid margin of its range in eastern Montana. Green ash is primarily a tree of humid to sub-humid climates, occurring mainly in bottom lands, so it is reasonable to assume that hydrology is an important limiting factor for the growth of green ash in eastern portion of the Custer Gallatin. In the first decade of the 21st century, winter (December-February) precipitation was approximately 25 percent lower than the 20th century average in southeast Montana. The winters averaged more than 3 degrees Fahrenheit warmer than in the last century (Lesica and Marlow 2013). Similar precipitation and temperature conditions in the first decade of the century were found in nearby South Dakota (Frankson et al. 2017). These conditions have probably reduced snow accumulations, early spring flows, and the deep water penetration into the soil compared to the past. Hydrologic conditions conducive to recruitment and growth of green ash seedlings in eastern Montana may have been sporadic, even prior to the introduction of Eurasian sod grasses into the woodland understory (Lesica and Marlow 2013). These conditions may be even less common now in a warmer, drier climate.

An increase of more drought-tolerant, grazing-adapted species and a decline in green ash tree seedling recruitment might be expected with a decrease in precipitation even in the absence of grazing. More open stands are associated with drier sites or regions. It is likely that the future climate of the northwestern Great Plains, in particular, might be characterized reduced precipitation, and increased temperature and frequency of extreme climatic events. Such changes could make recruitment of green ash from seed a rare occurrence in many stands at the arid edge of the tree’s geographic range (Lesica and Marlow 2013).

The emerald ash borer, a devastating invasive wood boring beetle native to Asia, is responsible for killing millions of ash trees throughout much of the Midwestern USA including green ash. The current closest infestations occur in eastern South Dakota, Colorado, and Minnesota. Movement of ash material from infested areas is now prohibited by Federal quarantine regulations. However, unintentional movement may still occur due to lack of awareness of the quarantine regulations into the plan area (for example, transported firewood, pallets). Detection of emerald ash borer infestations is difficult when trees are first attacked, showing few signs that emerald ash borer is present. However, healthy ash trees are killed in 2-4 years. Management strategies are outlined in appendix A of the Revised Forest Plan.

Xeric Woodlands

All the revised plan alternatives include specific desired conditions related to vegetation composition that will contribute to biodiversity and ecological integrity of xeric woodlands. Compared to the current forest plans, which do not explicitly describe desired conditions for xeric woodlands, this direction provides more detail as to the vegetation conditions and species composition to maintain or move toward.

Warming trends can impact xeric woodlands due to shifts in temperature and precipitation that may exacerbate existing stressors to these systems. Invasive grass species with higher flammability, like cheatgrass, can spread and increase fire frequency and range.

Grasslands and Shrublands

All the revised plan alternatives include specific plan components related to vegetation composition that will contribute to biodiversity and ecological integrity of grasslands and shrublands. Compared to the current forest plans, which do not explicitly describe desired conditions for grasslands and shrublands, this direction provides more detail as to the vegetation conditions and species composition to maintain or move toward. Plan components common to all revised plan alternatives require that vegetation management shall result in no net loss of priority or general sagebrush habitat or be beneficial to greater sage-grouse which is more limiting than the current plans directions. In addition, the revised plan alternatives also require that vegetation management projects be designed to remove or reduce invading conifers, control or stop the spread of invasive annual grasses, and to reduce the extent of existing nonnative plants. Plan components under all revised plan alternatives promote habitat heterogeneity, by creating a mosaic of burned and unburned areas (including different fire regimes for example, frequency, season, extent, intensity, type and time since last burn) during prescribed burns.

Warming trends can affect grasslands and shrublands because changes in temperature and precipitation affect vegetation growth and distribution. Expected effects on grasslands and shrublands are difficult to characterize as a result of uncertainty, regional variability, poorly understood vegetation dynamics, and complicated interactions and feedbacks. However, available research suggest some possible future implications of climate change for grasslands and shrublands under all alternatives.

Precipitation and temperature have been reliable predictors of the extent and distribution of plant groups (for example, cool-season C3 and warm-season C4 species) across the landscape (Epstein et al. 1997); (Knapp et al. 2001). Changes in these drivers have implications for vegetation. Rising carbon dioxide levels may complicate these relationships in the future, however. For instance, warmer and drier conditions should favor C4 grasses (Knapp et al. 2001, Winslow et al. 2003) so that short and tallgrass pine savannas may stand to benefit, but rising carbon dioxide should favor C3 species (Reich et al. 2001, Polley et al. 2003, Morgan et al. 2004). Further complicating these relationships are changing temperature and precipitation regimes. Increased variation, intensity, and changes in the timing of precipitation can also influence species composition and productivity of rangelands. For example, as springtime temperatures increase, the extent and magnitude of cheatgrass (a non-native) infestations may increase.

Ellison and Woolfolk (1937) documented the effects of a sustained drought near Miles City, Montana that peaked in 1934; this drought was aggravated by above-average temperatures and preceding years of below-normal precipitation. They documented substantial death of pine, juniper, and cottonwood, but also noted declines in sagebrush and other species. All shrubs experienced considerable dieback. Grass cover was reduced by up to 79 percent depending on the species. Effects of the drought were multiyear despite a favorable season in 1935. Needle-and-thread grass (*Hesperostipa comata*) and Sandberg bluegrass (*Poa secunda*) were able to recover relatively quickly, despite mortality, through the establishment of new seedlings. Stands of big sagebrush experienced considerable mortality and did not regenerate, whereas silver sagebrush (*Artemisia cana*) was able to resprout from the base. Therefore, based on this information, future sustained drought could result in declines in these vegetation types regardless of alternative, while other grass species such as Sandburg bluegrass and needle and thread grass increased. In addition, the study indicated that the favorable season following the drought failed to restore the perennial vegetation to anywhere near its former condition. The study concludes that to be in ecological balance with this droughty environment, forage use should allow for recovery and accumulate a forage reserve against future droughts.

Riparian, Wetlands, and Groundwater Dependent Ecosystems

All the revised plan alternatives include specific plan components related to vegetation composition that will contribute to biodiversity and ecological integrity of riparian, wetlands, and groundwater dependent ecosystems. Compared to the current forest plans, which do not explicitly describe desired conditions for riparian, wetlands, and groundwater dependent ecosystems, this direction provides more detail as to what vegetation conditions and species composition to maintain or move toward. All revised plan alternatives would emphasize riparian management zones and would facilitate management of multiple ecological goals and long term ecological sustainability on a landscape basis. Updated aquatic and riparian desired conditions, objectives, standards, and guidelines would be applied in a consistent manner across the Custer Gallatin National Forest. The revised plan alternatives would provide a mechanism to effectively prioritize activities and weigh multiple risks to various resources.

The road network on the Custer Gallatin and culvert failures / road slumps affect riparian vegetation on both a short- and a chronic, long-term basis. There are motorized roads open to the public as well as administrative use within the national forest administrative boundary, including roads managed by other entities such as state highways, a variety of county roads, Federal and state land management agencies, and private timber companies. Many roads and motorized trails are located within riparian management zones that include many stream crossings. Routes located closest to riparian areas potentially provide a background level of disturbance that contributes to direct and indirect effects on riparian soils, vegetation and function such as compaction and channel alteration. Motorized trails function similar to roads in regards to soil disturbance depending on frequency of use and traffic volume.

When mismanaged, livestock grazing can have numerous direct and indirect effects on riparian soils and vegetation. Soil trampling can cause decreased infiltration, greater soil compaction, and loss of vegetation cover on both upland and riparian sites. Reduced infiltration by soil compaction can lead to overland flow of sediment. Soil and water quality can be indirectly affected by the resulting increased soil runoff and erosion, and sediment delivery to riparian areas and streams.

Removal of riparian vegetation through livestock management can influence the amount of solar radiation and alter water temperature regimes. Greater temperature fluctuations (diurnal and seasonal) can occur when riparian vegetation is removed, decreased, or changed to more upland species. These changes can ultimately lead to shifts in dissolved oxygen and pH. In addition, removal of riparian vegetation and increased temperatures combined with increased nitrate levels can increase undesirable or nuisance biological production in water.

The effects of livestock can be seen across the Forest, particularly in riparian areas. Historical grazing led to riparian vegetation changes and stream channel degradation on grazed streams. Various allotments have seen improvements through best management practices and interdisciplinary review and updates to allotment management plans. However, riparian and aquatic habitat improvements within grazing allotments continue to be addressed and fine-tuned across the Forest on an allotment by allotment basis.

Perennial stream reaches in higher-elevation areas that have well-timbered valley bottoms and ground-water entry will be most resilient to warming conditions and changing weather patterns. Lower elevation stream reaches; lacking riparian shade, containing high sediment loads, with impaired width-depth ratios, and losing flows to groundwater; will be the least resilient reaches to changing conditions. Warmer, drier climates will influence species distributions and successional processes in complex and uncertain ways. Climate change forecasts for the northern great plains include reduced precipitation, longer dry periods, and an increased frequency of extreme weather events .Prairie streams, such as those in the Sioux and Ashland geographic areas, are dynamic, tending to vary between periods of floods and flow intermittency, among and sometimes within years (Dodds and others 2004). It is typical for prairie streams to be reduced to sets of disconnected pools in some years. Climate change is expected to exacerbate these patterns (Jaeger et al.2014) and lead to greater extremes, including severe droughts and more intense storms and wet intervals in plains and dryland systems (Michels et al. 2007, Starks et al. 2014).

Riparian Management Zones

Riparian management zones are areas where riparian-dependent resources receive primary emphasis and management activities are subject to specific standards and guidelines. These areas consist of riparian and upland vegetation adjacent to streams, wetlands, and other bodies of water and help maintain the integrity of aquatic ecosystems by (1) influencing the delivery of coarse sediment, organic matter, and woody debris to streams, (2) providing root strength for channel stability, (3) shading the stream, and (4) protecting water quality. Refer to the riparian management zone topic in the Watershed, Aquatics and Riparian Ecosystem section for definitions and extent of riparian management zones by geographic area (acreage).

Riparian conservation measures have been developed for Federal, State, and private lands—helping to preserve and protect the integrity of the riparian and wetland habitats as well as the water quality of associated waterbodies. Similar to riparian management zone protections, state streamside management zone protections have been applied on the Custer Gallatin in the past, but the new plan component direction under the revised plan alternatives is more comprehensive, will be applied across the entire forest, and will largely be consistent with other forests in Region 1.

All revised plan alternatives include new forest plan direction that establish designated widths of an inner and outer riparian management zone bordering streams, lakes, wetlands and other water features, as well as requires plan direction for management actions within the inner and outer riparian management zones in order to achieve watershed desired conditions (Refer to riparian management zones in the Watershed, Aquatics, and Riparian Ecosystem Section). Some activities are prohibited or restricted in the inner zone, whereas more active management is allowed in the outer zone. Riparian management zones are not intended to be "no touch zones," but rather "carefully managed zones" with an increase in protections in close proximity to water resources. Riparian management zones are portions of watersheds where riparian-associated resources receive primary emphasis, and management activities are subject to specific plan components including standards and guidelines. In order to achieve watershed desired conditions, some activities are prohibited or restricted in the inner riparian management zone, whereas more active management is allowed in the outer riparian management zone.

Recent research has documented that in some cases active riparian zone management can advance riparian condition while preserving the functional attributes for riparian, aquatic, and water resources. Even though similar concepts are currently being applied using state streamside management zone direction, the riparian management zone plan components in alternative B; the proposed action; are more prescriptive and were designed to improve riparian vegetation within the riparian management zones, while limiting activities that create long-term degradation, such as road building and clearcutting. Treatments would be designed to reflect the composition, structure and pattern of vegetation that would be consistent with the natural range of variability, as described in the desired conditions. The proposed riparian management zone standards in all revised plan alternatives differentiate between the inner and outer portions of streamside riparian management zones and riparian management zones around other water bodies with regard to limitations on vegetation management. Management of the outer riparian zone would allow for other management objectives such as reducing uncharacteristic fire as long as treatments did not create long-term degradation to riparian and aquatic condition. The proposed standards were developed to explicitly recognize that riparian management zones can benefit from active management and that the areas closest to water have greater importance for protection of water quality and aquatic resources based on the best available science.

The 2012 Planning Rule emphasizes integration of management direction in recognition of ecological sustainability and the interdependence of ecological resources, and the proposed riparian management zones would also contribute to wildlife habitat connectivity and protection of plant species and animal communities associated with wetlands. Riparian management zone direction under all revised plan alternatives was refined through plan components to guide appropriate management based upon best available science. The entire riparian management zone is classified as not suitable for timber production, based on the determination that a scheduled flow of commercial timber products using a rotation age could not be expected to occur on these lands due to management requirements and desired conditions for other resources. However, timber harvest is allowable, with restrictions as specified in the plan, such as to meet the riparian management zone desired conditions outlined in the revised plan. Other vegetation management activities that may occur and are expected to occur to maintain riparian conditions include prescribed fire, thinning, planting of trees or shrubs, and fuel reduction. Vegetation management in the inner riparian management zones would occur expressly to restore or enhance riparian, fish and aquatic resources, with specific exceptions. Vegetation management in the outer riparian zone, would allow more opportunity to manage vegetation resources to achieve desired vegetation and riparian conditions so long as conditions in the inner riparian management zone were not adversely affected and wildlife needs were met to achieve desired conditions.

Fire is a natural disturbance process that has historically influenced vegetation within watersheds, including riparian areas, grasslands, and forests adjacent to water features. The natural role of fire, as well as other natural disturbances, in creating the diversity of successional stages, species compositions and structures in riparian areas is incorporated into the design of the desired vegetation conditions outlined in the plan components. In areas where use of fire (including wildfire) or other natural disturbances is limited or not feasible, vegetation treatments could be applied where determined appropriate to achieve desired conditions within riparian management zones.

Existing grazing permits would continue to be administered under current allotment management plans. However, they would be required to meet or be moving towards desired conditions for riparian areas as outlined in the revised forest plan. When allotment plans are updated they would need to be adapted to meet or move toward riparian management zone desired conditions.

Forestwide plan components would protect riparian resources by minimizing the effects of grazing on these areas in all revised plan alternatives. Plan components specific to grazing, require that adverse effects to riparian habitats be avoided, minimized, or mitigated. Indicators such as forage use, bank alteration or riparian stubble height would be used to move rangeland vegetation, riparian function and wildlife habitat towards desired conditions. Forestwide guidelines would limit livestock handling and facilities management activities inside riparian management zones. All activities within riparian management zones, including grazing, are to protect key riparian processes, including maintenance of streambank stability, input of organic matter, temperature regimes, and water quality.

Riparian management zone plan components for grazing provide additional protection to riparian areas compared to the current plans. There are no differences in effects among the revised plan alternatives as all would adopt the riparian management zone standards and guidelines.

Protective measures for riparian areas include the delineation of riparian management zones around all water resources and the extent of unstable areas. Management activities within the riparian management zone must comply with all proposed direction, as well as the previously mentioned Federal and State best management practices and other State water quality regulations.

Floodplains would be managed by locating critical facilities outside of floodplains or by using structural mitigation measures. Additional protections are provided in forestwide standards and guidelines for management of riparian management zones.

The revised plan alternatives components are more prescriptive within riparian management zones than the current plans, which increases the likelihood of protecting wetlands or floodplains. Wetland values and functions would be protected in all revised plan alternatives through the implementation of the riparian management zone and by following the Forest Service’s National Best Management Practices for Water Quality Management on National Forest System Lands. Under the requirements of Executive Order 11990 and Clean Water Act, Section 404, wetland protection would be provided by ensuring that new construction of roads and other facilities would not have an adverse effect on sensitive aquatic habitat or wetland functions. In addition, wetland evaluations would be required before land exchanges or issuance of special-use permits in areas where conflicts with wetland ecosystems may occur.

Plan components have been designed to conserve riparian, wetlands, groundwater dependent ecosystems and protect floodplains under the revised plan alternatives which are more prescriptive than the current forest plans’ components. Executive Order 11988 also requires site-specific analysis of floodplain values and functions for any project occurring within the 100-year floodplain zone, and prior to any land exchange involving these areas.

Implementation of the riparian management zones plan directions would result in an improving water quality trend under all revised plan alternatives. There is no differences in effects among the revised plan alternatives, as all would adopt the riparian management zone plan components across the Forest. As the proposed forest plan directions are implemented in allotment management through terms and conditions of the permit, it is concluded that degraded riparian areas would move toward desired conditions.

Alpine

All the revised plan alternatives include desired conditions that will contribute to biodiversity and ecological integrity of alpine areas. Current forest plans do not explicitly describe desired conditions for alpine areas.

Under all alternatives, climate conditions influence effects to alpine vegetation. Elevation will play a large role in plant species composition in conjunction with predicted warming trends. High elevation, alpine or other fringe type environments may see plant species composition change first (Murphy and Weiss 1992). Invasive plants apparently have not yet become a serious problem in the alpine tundra of the Custer Gallatin National Forest, although yellow toadflax and Canada thistle are present above 9,000 feet and others have the potential to invade such areas in the future.

Long-term monitoring for some rare plant species indicated population resiliency or stability during the fluctuating climatic conditions that have occurred during the last two decades in the northern Rockies (Shelly, 2012 Seventh Montana Plant Conservation Conference). Peripheral populations to 12 arctic and boreal species were monitored over the last 20 years in Glacier National Park and The Nature Conservancy’s Pine Butte Preserve. It was found that of the 20 populations of 12 species monitored, 10 populations showed a significant decline; 9 were stable; and only 1 increased (Lesica, 2012 Seventh Montana Plant Conservation Conference). Therefore, alpine rare plants may have increased stressors from warming trends in the future.

Sparse Vegetation Types

The revised forest plan alternatives include specific plan components related to vegetation composition that will contribute to biodiversity and ecological integrity of sparse vegetation types. Compared to the current forest plans, which do not explicitly describe desired conditions for sparsely vegetated areas, this direction provides more desired condition detail as to what vegetation conditions and species composition to maintain or move toward.

Sparsely vegetated habitats are often fragile systems. Although recreation and road or trail construction can be threats to these habitats in the montane geographic areas, disturbance is often limited due to inaccessibility in the landscapes. Threats to the sparsely vegetated habitats on the Sioux and Ashland geographic areas include weed invasion, trampling from grazing, as well as shifts in warming and drying patterns. Shifts in warming or drying trends may also contribute to a change in range or distribution of these types (Halofsky et al. 2018b). Warming or drying climatic patterns could impact this system and the distribution of the peripheral, endemic, and rare species that occur within it. Historically, stand-replacing fires occur frequently in adjacent forests, woodlands and shrublands. Lightning strikes can cause fire within these systems, however due to minimal vegetation cover fire severity and spread is generally low.

Ecotones (upper and lower tree line)

The revised forest plan alternatives include specific plan components related to vegetation composition that will contribute to biodiversity and ecological integrity of ecotones. Compared to the current forest plans, which do not explicitly describe desired conditions for ecotones, this direction provides more detail as to what vegetation conditions and species composition to maintain or move toward. A decrease in non-forest cover types may occur as both a result of desirable reforestation of disturbed areas, as well as the loss of historic grass and shrubland communities to conifer encroachment.

At the broad scale, the expected effects of future warm, dry climate and drought include the maintenance or expansion of non-forested communities (particularly xeric types) as sites become drier or too frequently disturbed to support forest cover. Xeric ecotones are among the most sensitive ecosystems to climate change (Means 2011). Lower tree line woodlands are often thought to be "invading" desirable sagebrush and grass types due to fire suppression and grazing; however, ecotones also naturally more elevationally based on the dynamics of vegetation, climate and fire (ibid). Studies done near the Forest found that areas of mosaic sagebrush-grasslands with stable islands of Douglas-fir savannah have become dominated by Douglas-fir (Heyerdahl et al. 2006). Drivers of this trend include fire exclusion which would have killed encroaching trees when they were of a small size; grazing which reduced fine fuel loads and further influenced fire exclusion; and summer droughts that enhanced sagebrush which functioned as nurse plants for establishing conifers (ibid). Threats to the xeric ecotone include loss of tree species to disease, insects, and fire as well as shifts in warming and drying trends.

Forest Structure

All revised plan alternatives include specific plan components related to structural ecological components including size class distributions, the prevalence of large trees, forest density, snags, old growth and landscape pattern. This direction is expected to meaningfully contribute to the restoration and maintenance of biodiversity and ecological integrity of the Custer Gallatin. The current forest plans recognize the importance of diversity and heterogeneity in general but do not explicitly describe desired conditions for forested vegetation size classes. Direction in the revised plan alternatives provides substantially more detail and clarity as to what vegetation conditions to strive for.

Size Class and Large Tree Structure

Several desirable trends in forest size class were identified in the assessment and affected environment that would contribute to the overall Forest strategy of managing for ecological integrity and resilience. These include 1) increase the relative amount of large tree size class (over 15 inches average diameter at breast height) in all potential vegetation types; 2) decrease the amount of the medium size class (10-15 inches average diameter at breast height) in the Warm Dry and Cool Moist potential vegetation types; 3) decrease the relative amount of pole size class (5-10 inches average diameter at breast height) in the Cold and Warm Dry - Montane potential vegetation types; and 4) decrease the amount of seedling/sapling size class (under 5 inches average diameter at breast height) in the Warm Dry - Pine Savanna, primarily resulting from recent large, severe wildfires in this area. Figure 10 shows the predicted trends in forest size class over the next fifty years within each potential vegetation type. Because there was little variability in size class trends among alternatives, figure 10 shows averages across all alternatives. As noted earlier, models are of greatest value for comparison among alternatives and are not intended to be precise estimates. Model outputs augment other sources of information, including research and professional knowledge of how ecosystem processes (such as succession) and disturbances and stressors (such as fire, insect, harvest, and climate) might influence changes in vegetation conditions over time, especially at the scale of the planning unit. Refer to appendix B for further details on model development and results.

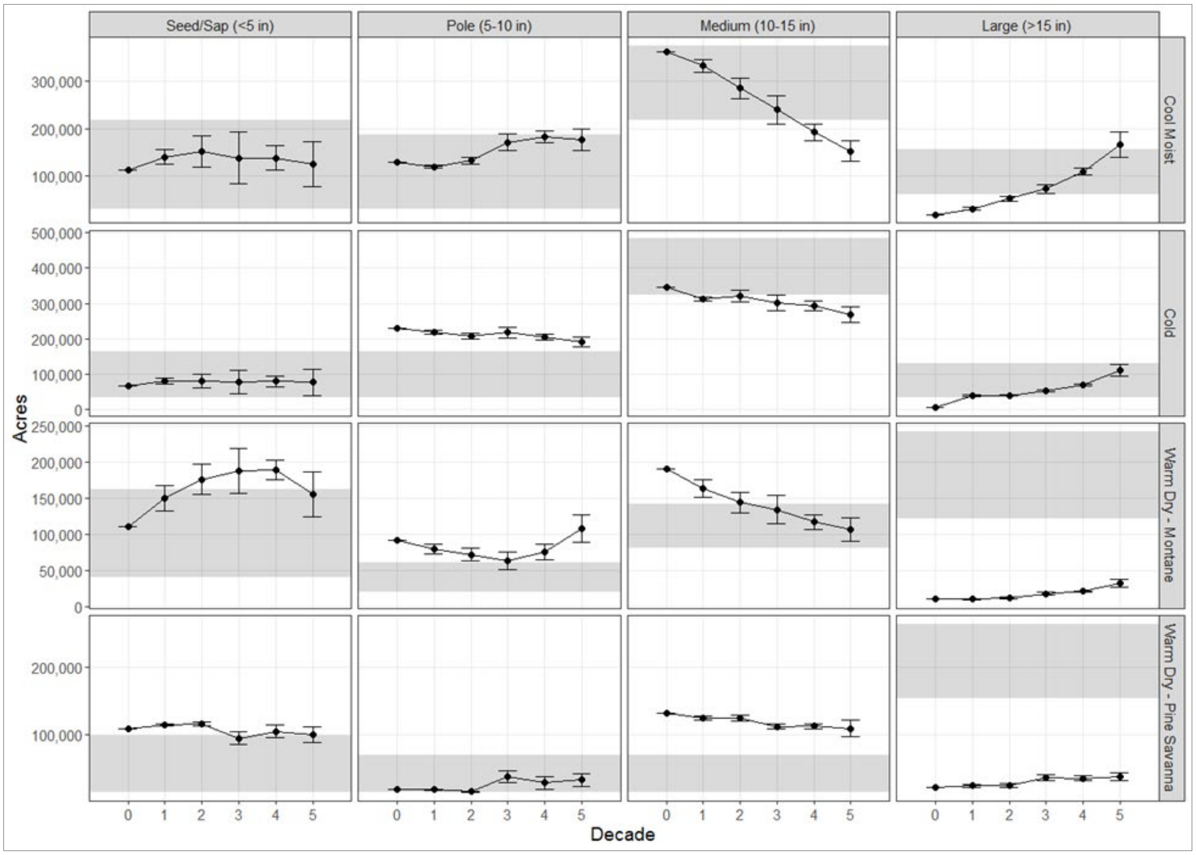

Figure 10. Change in size class over time. Shaded area indicates the desired condition. Because there was little variability among alternatives, figure shows averages across all alternatives (plus one SD).

Modeling results indicated that differences in the trend of size class distribution among alternatives is minimal but would generally maintain or trend towards the desired condition. These trends include an increase in the large tree size class as well as improvement in the other desirable trends identified above. Here again, the lack of difference among alternatives is due to the overwhelming effect of natural processes on ecological change – primarily wildfire and succession – relative to the effects of active vegetation management or differences in vegetation management objectives among alternatives.

The prevalence of the large tree size class is expected to increase in all potential vegetation types but particularly in the Cool Moist and Warm Dry potential vegetation types. Notably, the projected rate of increase for the large size class in the Warm Dry potential vegetation types is projected to be small, likely reflecting the generally low productivity and anticipated effects of large wildfires in these areas. The increases in the large size classes correspond to the reductions in the medium size class, attributable to natural succession as well as disturbances or management that reduce stand densities and remove smaller trees. Although SIMPPLLE is not able to model change in the “Large Tree structure” attribute directly (as defined by table 37 above), it is reasonable to expect the amount of large tree structure to also increase. These shifts will result in enhanced resilience to disturbance and structural diversity, contributing to the diversity of successional stages for wildlife habitat as indicated by the natural range of variation. The effects are the same across all alternatives.

Density

Analysis presented in the assessment and affected environment indicated a need to reduce high density forest vegetation in the Cold and Warm Dry – Montane potential vegetation types. Maintaining the desired distribution of forest density classes will help maintain/improve overall forest resilience and resistance, which is a key component of the Custer Gallatin's strategy for responding to future uncertainties such as climate change. The relative distribution of forest density classes will change thought time, trending towards the desired condition (figure 11).

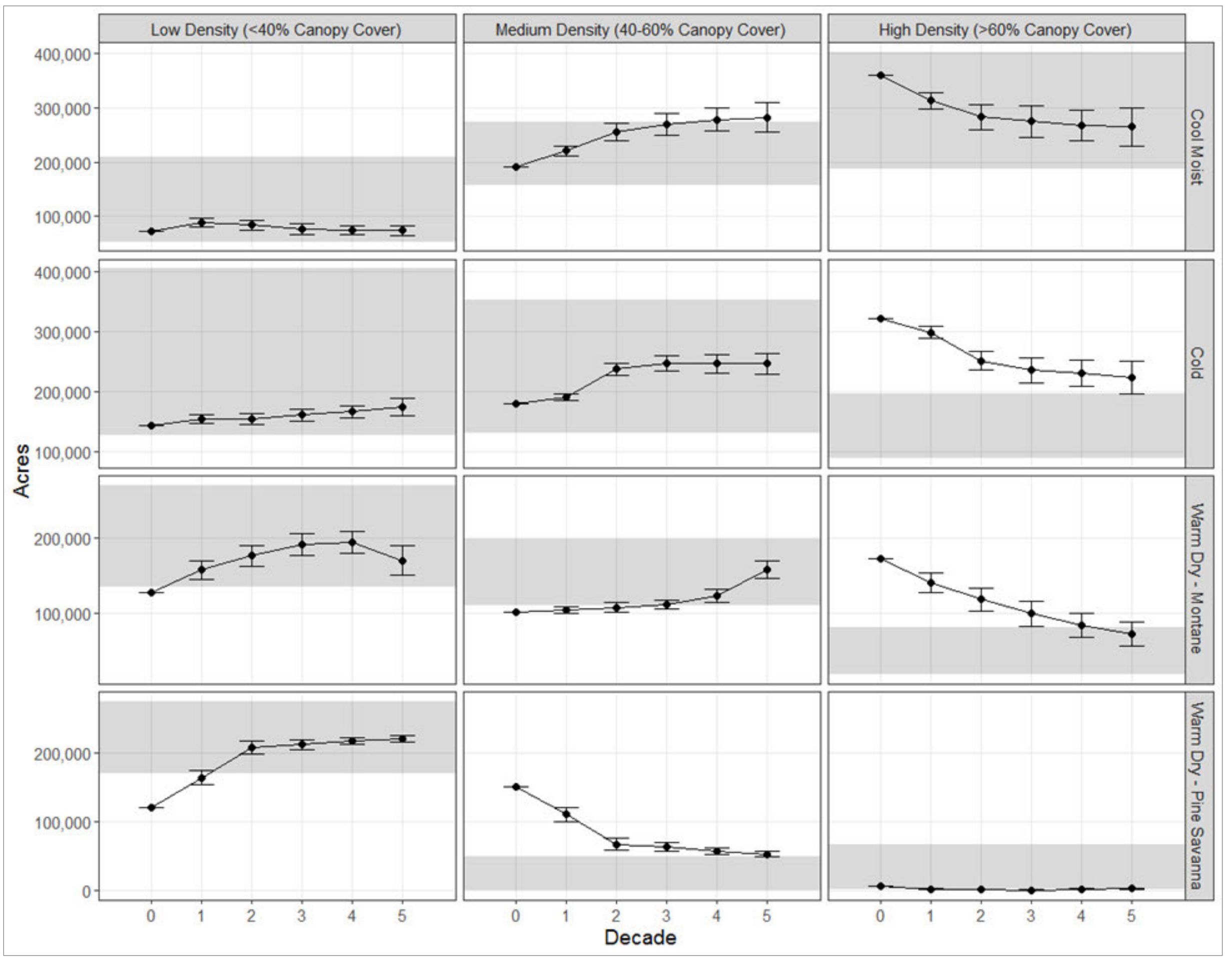

Figure 11. Change in density class over time. Shaded area indicates the desired condition. Because there was little variability among alternatives, figure shows averages across all alternatives (plus one SD).

At the forestwide scale, the expected trend of density class distribution would generally move towards the desired condition, including increases in the low/medium class and decreases in the high class where desirable. There is no appreciable difference among alternatives and the expected trends are conducive to promoting ecological integrity and resilience.

Snags

Forestwide, the Custer Gallatin National Forest is currently within the desired condition for snag density and distribution. While it is not possible to model the creation and decomposition of snags directly, one can assess the expected trends in the primary processes that create snags – fire and bark beetles – as a proxy to compare alternatives. Wildfire and prescribed burning would generally create snags in the short term, most often of the smaller size classes, although some snags and downed wood could be consumed. Bark beetles would tend to create medium, large or very large snags and not consume any existing snags or downed wood. After these events, the longevity of the snags would vary depending on species and site-specific conditions. For the purposes of this comparison, it is also assumed that timber harvest would generally reduce snag recruitment and retention, although appropriate levels of snags and downed wood would be retained as required by plan components.

As discussed above, it assumed that acres burned by wildfire will likely double relative to current planning period in the coming decades and this is the same across all alternatives (see appendix B For further information on this assumption). This equates to approximately 200 to 250 thousand acres per decade of wildfire in forested areas with a combination of low, mixed and high severity fire. An additional 25,000 to 40,000 acres of prescribed burning per decade, mostly low severity fire, will also help contribute to the recruitment of snags across the landscape. Bark beetles, another snag-producing ecological process, are expected to affect approximately 30,000 acres per decade. Although these are the most important producers of snags at large scales, snags will also be created though interacting effects of drought, pathogens, and competition.

While it is not possible to predict the precise extent and location of fires and bark beetles, the majority of forested lands are within areas where natural ecological processes and disturbances will be emphasized, such as wilderness areas and inventoried roadless areas. These areas range from approximately 64 to 67 percent of the forested area depending on alternative. Timber harvesting or firewood cutting would be very minor or non-existent in these areas. In these areas, natural processes are expected to create snags and downed wood conditions that would generally be within the natural range of variation, with the diversity of conditions at the forestwide scale that would provide habitat for wildlife species associated with dead wood components.

It is expected that lands managed for timber production will have lower snag densities than areas managed to allow natural processes (Ohmann and Waddell 2002, Wisdom and Bate 2008). While the amount of lands suitable to be managed for timber production varies by alternative, the difference among alternatives is relatively minor, ranging from a low of 18 percent of National Forest System lands in alternative D to 22 percent in the current plans. In lands suitable for timber production, all alternatives have plan direction that direct management of snags and downed wood within timber harvest units. These are designed to address the unequal distribution of snags and downed wood across the Custer Gallatin National Forest that may be the result of timber management or fuel reduction activities, and supports the active role that is more likely to be needed to achieve desired distribution of snag habitat conditions within these actively managed landscapes.

In summary, at the forestwide scale, the Custer Gallatin is currently within the desired conditions for snag density and distribution. In the coming decades, the primary snag-producing agents (fire and insects) are expected to increase in all alternatives, thereby increasing snag density and distribution across the landscape. In all revised plan alternatives, the number of snags required after timber harvest is higher than in the current plans. Moreover, in contrast to the current plans, the revised plan alternatives contain guidelines directing the retention of snags during salvage. As such, it is expected that snag density and distribution will be sustained or likely increase in the future, particularly under the revised plan alternatives.

Old Growth

It was not possible to directly model the trajectory of old growth as defined by Green et al. (2011). Never the less, the trajectory of large tree size class and prevalence of large tree structure (discussed above) indicate that the amount of old growth should also be increasing forest-wide under all alternatives.

Succession would continue to be the primary means by which old growth forest is formed. In all alternatives, fire and other natural disturbances would continue to influence vegetation and would remain the main cause of loss of old growth forest. Vegetation treatments that promote the long-term development of old growth (such as thinning in young stands to promote tree growth and retaining large trees) are management tools that are available in all alternatives. Old growth amounts and distribution would be dynamic and variable over time.

Predictions for warmer springs and warm, dry summers suggest that forests of the northern Rockies and the western United States will experience longer fire seasons, with larger and potentially more severe fires in the future. Therefore, existing old growth would be vulnerable to loss due to fire, as well as insects and disease, especially in drought prone areas. Fire exclusion and suppression in areas where a low or mixed severity historical fire regime occurred can alter vegetation structure and composition in old growth, and may make these stands more vulnerable to fire. Particularly on the Warm Dry potential vegetation type, increasing tree densities have increased tree stress and vulnerability to mortality from insects, pathogens, and high intensity crown fires. In these areas, silvicultural treatments in old growth with the purpose of increasing resilience are expected to have the effect of maintaining existing old growth longer in to the future.

While the desired condition to increase old growth in the revised plan alternatives would apply to all old growth types, FVEG-GDL-01, which limits vegetation management in old growth, would not apply to lodgepole dominated forest that meets the minimum criteria of Green et al. (2011). Lodgepole is a shade-intolerant, fire-adapted pioneer species that usually regenerates in dense, structurally homogenous, even-aged stands (Lotan and Perry 1983a;b). Because of this, silvicultural treatments have focused on clearcutting to recreate compositionally pure, even-aged, structurally homogenous stands. Although less common, lodgepole pine forests also occur in two-aged stands and in mixed -severity fire regimes (Arno 1980, Agee 1993, Axelson et al. 2009). However, uneven-aged silvicultural systems are less common because lodgepole pine tends to be easily wind-thrown and seedlings are very shade-intolerant but it can be an ecologically and economically viable option in certain situations (Hood et al. 2012, Keyes et al. 2014).

On the Custer Gallatin, most mature lodgepole pine stands range in age from 100 to 250 years old, have slow or stagnated growth and high mortality rates, and are slowly transitioning to younger stands dominated by more shade-tolerant species. Approximately 70 percent of the lodgepole pine dominated stands are outside of the suitable timber base and would not be available for active management. Because old growth lodgepole is naturally structurally homogenous, compositionally pure, relatively short-lived, and smaller in diameter than other species, it generally does not provide the high degree of structural complexity and ecological legacies as other old growth types. Silvicultural treatments in mature lodgepole pine are the most useful tool managers have to regenerate new stands, promote landscape heterogeneity, and sustain lodgepole pine ecosystems, including the recruitment of old growth. For these reasons, excluding lodgepole forests from FVEG-GDL-01 is expected to promote the long-term recruitment of old growth lodgepole forestwide and not have negative environmental consequences or detract from ecological integrity.

In summary, given the projected trends in large tree size class and plan components designed to protect and recruit old growth, it is expected that old growth will increase relative to current levels under all alternatives. However, in contrast to the current forest plans, all revised plan alternatives have a desired condition to specifically maintain or increase all old growth types above current levels (including lodgepole pine) and a guideline that limits timber harvest in old growth (with the exception of lodgepole pine). In addition, unlike the current forest plans, the revised plan alternatives contain a desired condition and associated guideline for retention of large tree structure – which are based on the Green et al. (2011) old growth criteria – which will also contribute to the maintenance of old growth, including lodgepole, over time.

Landscape Pattern

Unlike the 1986 and 1987 plans, the revised plan explicitly recognizes the importance of forest patterns in contributing to overall ecosystem and landscape resilience. The revised plan alternatives place greater emphasis on managing for landscape patterns that would be resilient to uncharacteristically large disturbance events and better provide for the connectivity of wildlife species (refer to wildlife section for details on wildlife effects). The desired condition is for the pattern of forest structures across the landscape to be consistent with the spatial and temporal arrangement that would occur under natural disturbance regimes. This is supported by desired conditions to maintain ecological processes within their natural range of variation which would, in turn, contribute to creating and maintaining landscape patterns consistent with the natural range of variation. In addition, the revised plan direction for maximum size of regeneration harvest units is more consistent with the natural range of variation than existing direction, making it more conducive to managing for a desirable landscape pattern.

As described in the affected environment section, an analysis of the natural range of variability was done to characterize the desired patch size distribution using four categories of patch sizes (under 40 acres, 40-100 acres; 100-1,000 acres and over 1,000 acres) and three broad successional stages: Early (under 5 inches diameter at breast height), Mid ((5-15 inches diameter at breast height) and Late (over 15 inches diameter at breast height). The analysis was stratified by Region 1 broad potential vegetation type to account for broad differences in disturbance regimes and be used to evaluate trends in landscape pattern and any important differences among alternatives. See appendix B for more detail on results of the patch analysis.

In summary, this analysis revealed that, here again, because the amount of treatment (management action) is predicted to be small relative to the amount of natural disturbance in all alternatives, there is minimal difference in the predicted trajectory of landscape pattern among alternatives. Moreover, landscape pattern will be overwhelmingly driven by natural processes, not vegetation management actions. However, across all alternatives, landscape pattern is generally expected to remain within or trend towards the desired condition. This is largely due the expectation that increased wildfire will begin to disaggregate large patches of mid-seral forest while natural succession increases the prevalence of late-seral forest, particularly in small to medium patch sizes. If, however, wildfires are larger and generally more severe than anticipated, it is possible that large patches of mid-seral forest will be converted to large patches of early seral forest. To avoid this, wildfires should be allowed to burn under less extreme conditions as reflected in the Desired Conditions and Objectives for wildfire management in the revised plan alternatives.

Consequences to Terrestrial Vegetation from Forest Plan Components Associated with other Resource Programs or Management

Effects from Timber Management

Timber management is one of the tools available to change vegetation conditions for purposes of maintaining or moving towards desired vegetation conditions. Plan components in all alternatives provide direction for timber harvest including identifying areas that are suitable for timber harvest and a standard that ensures restocking of trees in harvest areas. Forest plan direction limiting timber harvest activities are provided in a number of other sections of the revised plan alternatives for purposes of protecting other values associated with vegetation conditions such as harvest in riparian areas, in areas of known plant or animal species of conservation concern or threatened and endangered species and the suitability of harvest in designated areas (refer to respective sections of the plan for direction). The revised plan alternatives also include components to protect burned forest conditions and the habitat it provides for associated species. In contrast to the current forest plans, the revised plan alternatives contain direction that ensures snags and downed wood would be retained within salvage areas at levels that provide for snag-associated wildlife species. Over half of the Custer Gallatin National Forest is in wilderness or inventoried roadless areas, where harvest, including salvage, would be prohibited or greatly limited, and natural disturbances would be predominant, including fire that creates abundant burned forest conditions. Finally, the revised plan alternatives include direction for timber management that increases the maximum opening size that may be created through regeneration harvesting. Compared to the current forest plans, this direction is designed to be more consistent with the natural range of variation for early successional forest in each potential vegetation type. In total, the plan components addressing timber harvest will result in harvest activities helping to move vegetation towards desired conditions and, in turn, promote ecological diversity and integrity. Based on the PRISM model, alternative D contains the most acreage of predicted timber management activity (emphasizing cutting of small diameter trees) followed by the current plans and alternatives B and C, which are all similar. Alternative E has the least amount of timber management acres total but the highest number of acres scheduled for regeneration harvest and the highest predicted timber volume due to the emphasis on timber production.

Effects from Fire and Fuels Management

Components associated with fire and fuels management in the revised plan alternatives strive to restore natural fire regimes and will help achieve vegetation desired conditions, and therefore generally result in positive impacts to terrestrial vegetation. Management of unplanned ignitions can be the only feasible management option in landscapes where mechanical treatments are not allowed or are impractical. For the revised plan alternatives, objectives for both managed wildfire and fuels reduction are complementary to other desired vegetation conditions, especially related to forest resiliency. In contrast to the current forest plans, the revised plan components are designed to explicitly and affirmatively recognize the natural role of fire on the landscape and its importance in shaping the ecosystem, while also protecting values at risk.

The PRISM model was used to generate the best solution for applying future prescribed fire to move towards desired conditions while considering resource constraints and management guidance for each alternative. These treatments were only applied in forested lands, because that is the focus of PRISM modeling. However, additional prescribed burning in non-forested vegetation types would also occur. The PRISM model projects that all alternatives except D would apply similar levels of prescribed burning, approximately 30,000 to 32,000 per decade on average over the first two decades. Alternative D would apply the most prescribed fire to the forested landscape, approximately 38,500 acres on average over the first two decades. Fuels treatments are expected to follow a similar pattern with the highest amount of fuels treatment in alternative D. Alternative D differs in this way because it emphasizes treating the greatest number of acres to achieve desired conditions and prescribed burning and fuels treatments are often a cost-efficient tool for achieving this objective.

In lands within the wildland urban interface and near communities, there would likely be a continued emphasis on fuels management. To achieve plan components associated with fire and fuels management in wildland urban interface, there may be areas where forest conditions are created and maintained over the long term at lower densities, for example, generally open and park-like conditions. This would often be consistent with the natural disturbance regime found on many sites, such as in the warm dry potential vegetation group. However, in cases where cool moist forest types are found in the wildland urban interface the site-specific conditions could be more open than what would occur under natural disturbance regimes. This effect is common to all alternatives.

Effects from Air Quality Management

The consequences to terrestrial vegetation from air quality related forest plan direction are the same for all alternatives. All alternatives have direction to meet air quality standards established by Federal and State agencies and meet the requirements of state implementation plans and smoke management plans. The direction limits how much can be burned and when and where it can occur. The costs of conducting prescribed fires increases as a result of the burning regulations, which affect how much is burned. The ability to implement the vegetation treatments that would occur as a result of the alternatives is dependent upon prescribed burning as well as using natural, unplanned ignitions to meet resource objectives. Therefore, to the extent that air quality regulations may become more stringent in regards to the quantity and timing of smoke emissions, there could be limitations to conducting prescribed burning.

Effects from Watershed, Soil, Riparian, and Aquatic Management

All alternatives contain direction that protects watershed integrity, soil productivity, riparian values and aquatic habitat management. For the revised plan alternatives, these plan components are much more specific and based on the concepts of the natural range of variation and focused on maintaining ecosystem integrity. As such these plan components may influence project design locally but would generally complement and not preclude the achievement of the terrestrial vegetation desired conditions. In contrast to the current forest plans, revised plan components addressing watershed protection, soils, and riparian areas are much more specific and quantitative in the revised plan alternatives which is expected to better facilitate protection of these resources.

Effects from Wildlife Management

By and large, terrestrial vegetation may be influenced by wildlife-associated plan components that limit the location, access, timing or duration of vegetation management, and in some cases require certain vegetation conditions. Plan direction for grizzly bears and lynx will follow regional guidance associated with these species which is the same across all alternatives. In the current forest plans, many of these elements are blended into management area guidance. The vegetation-related wildlife plan components would provide for the wildlife habitat conditions that support the full suite of native species. Species–specific direction in the revised plan alternatives would not compromise the integrity of terrestrial vegetation as a whole but would provide additional restriction as necessary to maintain or restore populations. This is the basis of the coarse-filter / fine-filter approach to providing ecological integrity as described above.

Effects from Land Allocations

Plan components related to management of areas such as wilderness areas, wilderness study area, recommended wilderness areas, inventoried roadless areas, research natural areas, special areas, wild and scenic rivers, backcountry areas, and recreation emphasis areas, etc. can affect vegetation management by requiring specific design criteria and considerations for management activities or by restricting availability of lands to harvest, a primary tool of vegetation management. All alternatives vary by the amount of land managed under the direction of specific land designations (table 2 in chapter 2).

For some areas, the effect to terrestrial vegetation forestwide would be minimal. For example, public safety issues in developed and undeveloped recreation sites may limit the ability to maintain the desired snag levels that are indicated under the revised plan alternatives. However, because these recreation areas are generally small in size, the effect of having fewer snags or the ability to meet the forestwide desired conditions is negligible.

Plan components associated with recommended wilderness could have significant effects on the vegetation management tools available and the design of vegetation treatments that may be suitable. Although timber harvest is not suitable in these areas, management actions that restore natural processes and vegetation would be permitted. The most likely treatments would be associated with whitebark pine restoration and prescribed burning (planned ignition), in some cases followed by limited planting of conifer seedlings for the purposes of restoring desired forest structure and composition, and to restore desired landscape patterns.

However, regardless of the mix of land allocations, forestwide vegetation desired conditions would be the same under all revised plan alternatives and comparable to the current forest plans. As such, the primary effect of recommended wilderness and other land allocations would be limiting the management flexibility (such as, timing, design, available tools, size of treatments, etc.) to achieve or maintain these conditions in these areas. Restrictions associated with land allocations were incorporated into the modeling process and effects are embedded in the outputs shown above.

Effects from Access and Road Management

Past road construction has reduced acres of native meadows and shrublands. Roads constructed in and along valley bottoms have reduced or altered riparian vegetation and sometimes changed stream channel location and function. Roads tend to create one of the largest impacts on the health and sustainability of stream/riparian/wetland systems. General effects include lowered water tables, fragmented riparian areas, altered morphology, changed sediment regimes, and removal of canopy cover and other vegetation. Unauthorized off-road vehicle travel has an effect in moving vegetation to an earlier seral condition. Plan components associated with road management strive to have minimal impacts on ecological integrity and diversity, which generally result in positive impacts to terrestrial vegetation. In all alternatives, limits related to road access on existing roads as well as construction of new roads (both permanent and temporary) could have an impact on the ability to conduct vegetation treatments that require road access, particularly mechanical treatments, across portions of the Custer Gallatin. Limited access to conduct desired vegetation treatments would affect the ability to achieve desired vegetation conditions in some areas. Plan objectives for all alternatives would remove 40 miles of road, which would limit access but benefit riparian vegetation in the long term depending upon the proximity and extent of roads near water.

Effects from Recreation Management

Recreation use can affect vegetation especially in the case of repeated or continual uses such as camping, fishing, and hiking, horseback riding, snowmobiling, recreational gold panning, or off-road vehicle use. Generally, the number of acres impacted is a very small but can nevertheless have site-specific impacts. Under all alternatives, plan components associated with recreation management strive to have facilities, trails, and dispersed camp sites contribute minimal impacts on ecological integrity and diversity, which generally result in positive impacts to terrestrial vegetation.

Recreation opportunity spectrum designations regulate motorized and nonmotorized recreation and may also influence the design or the location of on-the-ground projects as described in the associated plan components. For example, the desired condition for semi-primitive nonmotorized recreation opportunity spectrum classification is that vegetation management does not dominate the landscape or detract from the experience of visitors. The consequences that would result from the current forest plans are fairly similar to the revised plan alternatives.

Effects from Scenery Management

Direction for scenery and recreation management in the revised plan alternatives affect the type of vegetation treatments that could occur in some areas across the Forest. For example, scenic integrity objectives (lowest scenic levels allowable) do not outright prohibit vegetation management, but may influence the design or the location of on-the-ground projects that would be visible from any of the listed critical viewing platforms. Design features or mitigations may be required to meet or exceed the assigned scenic integrity objective, which describes the maximum threshold of visual dominance and deviation from the surrounding scenic character.

Effects from Permitted Livestock Grazing

In all alternatives, livestock grazing would occur on portions of the Custer Gallatin National Forest. Plan components would enable grazing activities to complement terrestrial vegetation management, such as reducing fine fuels to lower fire risk. While grazing and trampling from livestock can damage native plants and tree seedlings and saplings, plan components are in place that would ensure that grazing is managed to promote sustainable and vigorous native plant communities. Further, components are in place that would ensure that grazing does not adversely impact the regeneration of forests, or re-seeding of non-forested areas with desirable native vegetation. Plan components would also ensure that grazing is managed in a manner that would not lower site productivity (through damages such as compaction), and limit the spread of invasive plant species into native plant communities.

Perennial riparian vegetation on or near the water’s edge (greenline) encounters the most erosional stress during floods. Flooding is a natural disturbance process that maintains heterogeneity in riparian and in-stream structure, function, and composition (Naiman and Decamps 1997). The natural disturbance regime effects of flooding can be compounded by various land-use practices resulting in decreased riparian function. Riparian vegetation has the best opportunity to slow velocity and induce deposition of materials, stabilize banks, and re-create channel pattern, profile, and dimension appropriate for the landscape setting. Where streambank instability or changes in channel form may arise from channel widening or channel incision, vegetation along the greenline is most critical. Depending on site potential, greenline, riparian, and floodplain plant communities also contribute wood and aid floodplain energy dissipation, sediment and nutrient sequestration, and aquifer recharge (Swanson et al. 2015).

Annual indicators of livestock grazing use, such as within season or end of season stubble height, streambank alteration, woody species utilization, and upland utilization or residual, are valuable tools in providing a link between on-the-ground management and attainment of long-term desired conditions. When properly designed and supported by best available science, and properly implemented, annual indicators provide a reasonable assurance that if they are consistently met, long-term desired condition attainment would be expected within reasonable timeframes. As such, they provide a short-term means of adapting management on an annual basis to meet or move toward the long-term desired conditions.

All the revised plan alternatives have an end of season stubble height guideline (see guidelines in livestock grazing section) that would improve potential effects to aquatic habitat from livestock grazing on specific stream types. End of season stubble (greenline hydrophilic vegetation height) has been shown to be a good indicator of two primary factors: 1) the effect of grazing on the physiological health of herbaceous, hydrophilic plants, and 2) the ability of the vegetation to provide streambank protection and bank building function. In addition, indirect benefits occur as well. Using stubble height to monitor foraging behavior (for example, shifts to browsing willows) and physical impacts (for example, trailing) can be as important as maintaining stubble heights that support plant vigor and sediment deposition (Skinner 1998).

Effects from Minerals Management

Exploration and production activities could disturb or otherwise affect vegetation but the extent is dependent upon the amount of exploration, reclamation requirements and resultant production. Under all alternatives, the expected effects to vegetation are considered minimal across the Custer Gallatin given the amount of anticipated minerals activity coupled with plan components for energy and mineral resource development that consider other resources.

Cumulative Effects

The effects that past activities have had on all of the components of forest vegetation (such as, forest composition and structure, landscape pattern, etc.) were discussed in the “Affected Environment” section and are reflected in the current condition of the forest vegetation. Therefore, unless otherwise noted, past activities are not carried forward into the following cumulative effects analysis. Present and foreseeable future activities that could affect forest vegetation are summarized below.

Increasing Human Population

Additional stressors that may increase in the future are increasing population levels, both locally and nationally, with resulting increasing demands and pressures on public lands. As related to forest and vegetation conditions, these changes may lead to increased demands for commercial and non-commercial forest products, elevated importance of public lands in providing for habitat needs of wildlife species, and changing societal desires related to the mix of uses public lands should provide.

Regulations and Public Concerns Regarding Smoke Emissions

The ability to implement the vegetation treatments that would occur as a result of the alternatives is highly dependent upon prescribed burning (both associated with timber harvesting and without it) as well as using natural, unplanned ignitions to meet resource objectives. Therefore, public concern about smoke and associated air quality regulations could have substantial effects in limiting vegetation treatments using fire and meeting desired vegetation conditions.

Management of Adjacent Lands

Portions of the Custer Gallatin National Forest adjoin other national forests, each having its own forest plan. The Custer Gallatin National Forest is also intermixed with lands of other ownerships, including private lands and State lands. Some geographic areas contain significant inholdings of such lands, while others are more unfragmented in terms of ownership. The geographic areas that are island mountain ranges are largely surrounded by private lands. Harvesting or conversion of forests on adjacent lands would affect vegetation conditions at the landscape level. State law applies to all activities regardless of ownership; therefore, basic resource protections would be consistent. However, vegetation management practices on other lands, particularly private lands, would not necessarily be conducted to meet the same desired conditions as those outlined in the Custer Gallatin National Forest plan.

The forest plans for National Forest System lands adjacent to the Custer Gallatin include the Helena, Lewis and Clark, Beaverhead-Deerlodge, Caribou-Targhee, and Shoshone. All of the forest plans contain plan direction that addresses terrestrial vegetation and promotes ecological integrity. Management of vegetation is broadly consistent across all National Forests due to law, regulation, and policy. The cumulative effect would be that the management of vegetation would be complementary. Some adjacent lands are subject to their own resource management plans relevant to terrestrial vegetation.

Montana State Parks and Recreation Strategic Plan 2015-2020 complements vegetation management on the Custer Gallatin by including strategies related to increased resilience, wildfire safety, and providing wildlife habitat. State forest lands may be actively managed to a greater degree than National Forest System lands, and would likely contribute to achievement of desired vegetation conditions across the landscape. The cumulative effect would likely be additive, in terms of moving towards the vegetation desired conditions as described in the revised forest plan. The Montana State Parks and Recreation Strategic Plan guides the management of state parks, some of which lie nearby or adjacent to National Forest System lands. Terrestrial vegetation is a component of these parks, although not always the primary feature. Specific vegetation conditions would not necessarily contribute to the desired conditions as described for the Custer Gallatin. Both South Dakota’s and Montana’s State Wildlife Action Plans describes a variety of vegetation conditions related to habitat for specific wildlife species. These plans would likely result in the conservation of these habitats on State lands, specifically wildlife management areas. These plans would be likely be consistent with desired conditions of the Custer Gallatin.

South Dakota’s Wildlife Action Plan uses an ecosystem approach to assess the health of South Dakota’s fish and wildlife and associated habitats (South Dakota Department of Game 2014). The plan not only evaluates the challenges species of greatest conservation need face and outlines actions to help conserve them for the long term, but it also refers to the terrestrial and riparian-wetland ecosystems' planning approach, which encourages voluntary actions among conservation partners, agencies (such as the U.S. Forest Service), Tribes, and individuals to provide habitats that occurred prior to European settlement of South Dakota, with the expectation that this approach will accommodate the needs of the majority of species. The concept of using an historical reference is based on the fact that the array and distribution of ecosystems across South Dakota shaped and sustained the region's biological diversity and that most fish and wildlife species in South Dakota today resulted from historical ecosystems and associated disturbance regimes in the Great Plains.

The identified terrestrial and riparian habitats for South Dakota's species of greatest conservation need use a coarse filter / fine filter strategy to assure that terrestrial and riparian-wetland habitat needs are met. This approach is complementary to the plan components for the Custer Gallatin National Forest. The approach establishes a baseline condition (historical reference) at a time prior to European settlement. A critical consideration in the terrestrial approach is an understanding of natural disturbance regimes, such as fire, flooding, and grazing patterns, which acted upon habitats. For example, the Sioux Ranger District terrestrial habitats would be classified under the Natural Resources Conservation Service Ecological Sites of Northern Rolling High Plains (Eastern Part) and a small portion of Rolling Soft Shale Plain. Riparian hierarchical framework were adapted from the Missouri River Gap Analysis Project to identity Conservation Opportunity Areas.

Bureau of Land Management lands near the Custer Gallatin are managed by the Dillon (2006 plan), Butte (2009 plan), Billings (2015 plan), Miles City (2015 plan) and South Dakota (2015 plan) field offices. These plans components related to resilient terrestrial vegetation are complementary to the plan components for the Custer Gallatin; timber management would generally be conducted in a similar manner and with similar results.

The Foundation Document for Yellowstone National Park calls for preserving natural vegetation, landscapes, and disturbance processes. Broadly, the terrestrial vegetation characteristics in this area are therefore likely similar to the wilderness areas in the adjacent Absaroka Beartooth and Gallatin, Madison, Henrys Geographic Areas and would complement these conditions. By managing for ecologically based desired conditions and resilience, any vegetation management activities in non-wilderness areas adjacent to Yellowstone National Park would also be consistent with this plan.

Many of the county growth plans associated with the Custer Gallatin Forest emphasize an interest in resilient forests and promoting the sustainability of forest landscapes. As such, vegetation management would remain an important feature in the local communities. Some county wildfire protection plans map or define the wildland urban interface. The Custer Gallatin notes that these areas may be a focus for hazardous fuels reduction, and other plan components (such as Northern Rockies Lynx Management Direction) have guidance specific to these areas. Vegetation management, including harvest, may be emphasized in these areas more so than others. Managing for open forests and fire adapted species may be particularly emphasized in these areas. Overall, the effect of the county plans would be to influence where treatments occur to contribute to desired vegetation conditions.

Conclusion

The following key points summarize the conclusions for terrestrial vegetation:

- The suite of components associated with terrestrial-vegetation in the revised plan alternatives is designed to maintain or restore the ecological integrity of the Custer Gallatin National Forest. For example, desired conditions describe increases in large trees and large forest size classes, more open forest densities in some potential vegetation types, vigorous non-forested plant communities dominated by native species and maintaining the full range of biodiversity on the landscape. These conditions are consistent with the modeled natural range of variation and most likely to be resilient to future environmental conditions.
- The current forest plans generally recognize the importance of ecosystem diversity and heterogeneity but the revised plan alternatives reflect substantially more ecological thinking and more detail regarding which vegetation conditions will provide for ecological integrity and resilience.
- Expected trends for key indicators of terrestrial vegetation forestwide show progress towards desired conditions but little variability across alternatives. This is primarily due to the limited scope and impact of vegetation management treatments relative to the size of the national forest and the effects of natural disturbances, particularly fire.
- Regardless of alternative, models of future vegetation conditions predict:
    - ♦ Wildfire will be the dominant force driving change in ecosystem composition, structure and function at the forestwide scale.
    - ♦ The amount of large tree size class and large tree structure will increase. This will likely result in an increase in old growth forest.
    - ♦ The distribution and dominance of whitebark pine and ponderosa pine will increase. However, despite these model results, there remains a high degree of uncertainty about these species as discussed above.
    - ♦ High density forest will decrease, primarily due to the effects of wildfire.
    - ♦ The distribution of patch sizes will generally stay within or move towards desired conditions, largely due to the anticipated effects of wildfire.

3.7 Fire and Fuels

3.7.1 Introduction

Fire is a necessary and critical ecological function across the Custer Gallatin National Forest that plays a central role in providing quality habitat for both plant and wildlife species. Wildland fires are both wildfire (unplanned ignitions) and prescribed fire (planned ignitions). Fire management include the strategies and actions used both before and during wildland fire. Management of wildland fire influences whether fire effects create beneficial or negative impacts to water and air quality, habitat, recreation areas, or communities. Wildfire management, and subsequently risk management, include a spectrum of responses from protection to resource objectives. Suppression is a management strategy used to extinguish or confine an unwanted wildfire. Fuels management is the manipulation of vegetation to change fire characteristics when it burns.

Wildland Fire Management

Fire on the landscape is considered a natural process and many fires on the Custer Gallatin are started by lightning. However, humans have also been a source of fire on the landscape for centuries, and intentional or not, have influenced vegetation successional dynamics. Fire is not a simple process and many factors influence its character, including fuel loadings, climatic and weather conditions, topography, vegetation structure and composition, and elevation.

All wildfires are managed on a continuum between meeting protection objectives and resource objectives, and the mix of these objectives are based both on the location of a wildfire (or a portion of) and the condition under which it is burning. These objectives come from the desired conditions in the forest plan. The burning conditions change through the season and from year to year, providing both opportunities and restrictions.

Forest Service policy dictates that every wildfire has some aspect of a protection objective in a fire management response (NIFC 2017). This response can vary from monitoring the fire under conditions that are conducive to obtaining resource benefits, to an aggressive suppression effort to protect communities and values at risk from potential damages. Factors in all wildfire management decisions include firefighter and public safety, risk to property, fire resource availability and national/regional priorities, costs, and potential resource benefits; wildfires are not allowed to just burn.

The Forest Service manages wildfires to meet resource objectives; using unplanned natural ignitions to achieve these objectives and ecological purposes to foster resilient ecosystems. The benefits of managing wildfires to meet resource objectives may include: reducing fuels so that future fires burn in that area with lower severity ecosystems, (Parks et al. 2014), increasing biodiversity (Martin and Sapsis 1992), cycling nutrients back into the soil (Hungerford et al. 1991)), or reducing forest density to favor fire resistant species (Agee 1993).

Circumstances where wildfires are suppressed take into account certain fuel and weather conditions, proximity to values at risk, time of year, or fire effects that are predicted to move the landscape away or not maintain desired conditions. However, when natural fires are suppressed in fire-adapted ecosystems, there could be detrimental effects to vegetation composition and structure, ecosystem processes, soil dynamics, wildlife habitat and biodiversity (Keane et al. 2002). In combination with climate change, land-use change, and 20th century fire exclusion, suppression of wildfires also increases the existing fire deficit (Marlon et al. 2012).

Effective management sees to the nature of wildfire and its contributing factors, recognizes the positive and negative consequences involved, addresses uncertainty, and develops responses that reduce the chances of catastrophic losses (U.S. Department of Agriculture and U.S. Department of the interior, 2014). Forest and fire managers need to manage risk both short and long term. In the long term, risk to communities and assets will be reduced when potential positive and negative consequences of fire are recognized and management actions to obtain positive outcomes are matched; fire will be restored as an ecosystem function to the landscape, and smoke impacts to communities will be reduced.

Wildfire Risk Management

The wildfire risk management process involves making decisions and taking actions to control and accept risks. This is done by identifying, assessing, and prioritizing risks followed by the coordinated and economical application of resources to minimize, monitor, and control the probability or impact of unfortunate events (Thompson and Calkin 2011). The Forest Service uses scientific assessment to determine where individual wildfires are likely to have negative or positive outcomes. Assessments are based upon a detailed quantitative analysis of the location of values at risk (such as water sources, communities, or recreation sites) and the likelihood of fire starts (often called "ignitions"), fire spread, and fire intensity.

A wildfire risk assessment can be visually depicted with the "wildfire management continuum," which was created to show how wildfires may be managed for one or more objectives (Thompson et al. 2016). The basics of the wildfire management continuum can be described according to four dimensions (figure 12).

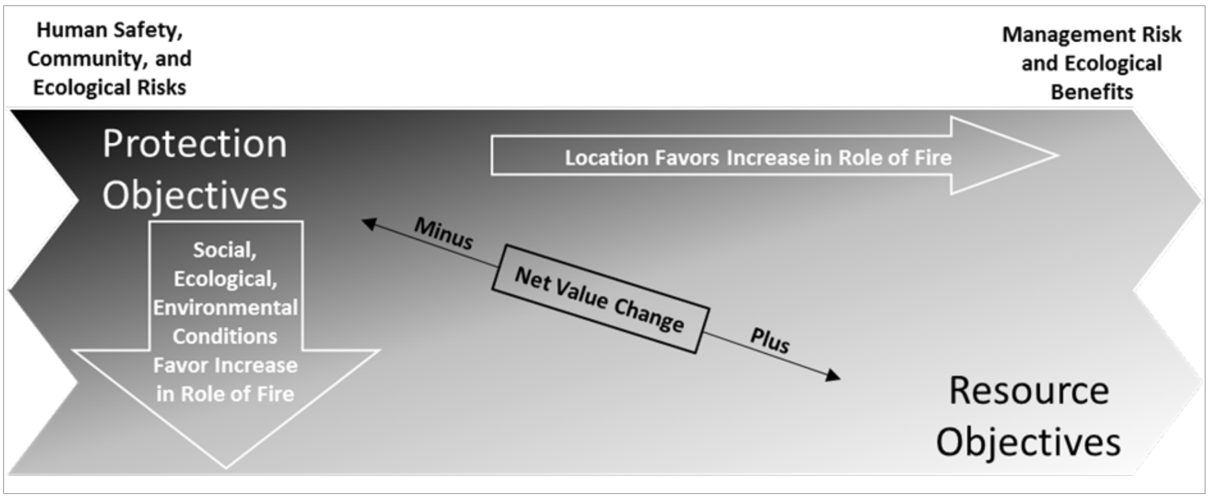

Figure 12. Wildfire management continuum (adapted from Thompson et al. 2016)

The length (side to side) of the continuum shows the spatial component, or the location on the landscape. The location also affects the mix of objectives: on the left, it favors protection objectives, whereas on the right it favors resource objectives.

The width (up and down) of the continuum illustrates the different social, ecological or environmental conditions affecting the mix of objectives. On the top, protection objectives prevail, whereas on the bottom resources objectives are easier to obtain.

The gray scale depicts the range of objectives, taking in the combination of both location and conditions. Black (upper left) represents how the combination of conditions and landscape location can experience higher risks to communities or ecological resources, which result in protection as the predominate objective. White (lower right) has the combination of low-risk conditions and landscape location that make managing for resources the primary objective. The colors also represent the net value change to natural resources and community assets; black indicates a negative change (damage) while white indicates a positive change (benefit). The fire management response is to protect from potential damage and to obtain benefit. As risk is lowered on the landscape, more positive net value change opportunities exist over more locations and conditions, therefore increasing the ratio of white to black.

The teeth on each end of the continuum indicate that it wraps around to form a cylinder. A wildfire on the far left could be near an area with high risk and management of that portion of the fire would be to meet protection objections. Whereas, a fire on the right side being managed primarily for resource objectives may change to a fire managed for protection objectives due to environmental changes that caused it to grow and threaten resources and assets.

Fuels Management

Fuels reduction treatments primarily consist of thinning and prescribed fire, but can include other treatments like mowing, herbicide application, and seeding. In accordance with applicable laws, policies, and regulations to meet specific objectives, prescribed fires are intentionally ignited. Mechanical treatments include the use of equipment, such as feller-bunchers or chain saws, to perform activities that change vegetation composition and structure and alter fuels to reduce hazard. Prescribed burning often follow mechanical treatments. The focus of the fuels management program has been to modify the fuel conditions to meet varying objectives to reduce threats to values at risk, increase suppression success by minimizing crown fire likelihood, decrease fire intensity, or decrease rate of spread.

Fuels reduction treatments center on the part of fire environment that can be altered, resulting in a change in the amount, configuration, and spacing of live and dead vegetation. The costs, environmental impacts, and effectiveness of different fuel treatment types vary. Desired outcomes of fuels treatments include more manageable fire behavior and reduced severity during wildfires (Reinhardt et al. 2008), although under extreme weather conditions these benefits can be sustained, reduced, or even negated (Graham 2003). Additional benefits consist of, minimizing impacts to values at risk and reducing fire spread to other ownerships. Strategically located fuels treatments provide opportunities to proactively manage the size and costs of future wildfires (Thompson et al. 2013). In addition to modifying fire behavior, fuels treatments achieve multiple resource benefits, such as, meeting desired vegetation conditions, creating desired wildlife habitat, and producing timber products.

As human development expands into more remote areas, the wildland urban interface will continue to grow. The wildland urban interface designation affects all fire management decisions in those interface areas. Although a wide variety of fire management strategies are available to implement, these options are usually narrowed down due to concerns that fire may move from Federal to private lands. Hazardous fuels treatments in the wildland urban interface focus on manipulating the vegetation to enhance the success of fire suppression activities.

Regulatory Framework

Wildfire Suppression Assistance Act of April 7, 1989 (HR 4936): Authorizes reciprocal fire protection agreements with any fire organization for mutual aid with or without reimbursement and allows for emergency assistance in the vicinity of agency facilities in extinguishing fires when no agreement exists.

Healthy Forests Restoration Act of 2003 (HR 1904): Aimed at expediting the preparation and implementation of hazardous fuels reduction projects on Federal land; encouraging collaboration between Federal agencies and local communities; requiring courts to balance effects of action versus no-action prior to halting implementation; and requires Federal agencies to retain large trees under certain conditions.

"Urban Wildland Interface Communities within the Vicinity of Federal Lands That Are at High Risk from Wildfire" Federal Register Vol. 66, No. 3, 2001: List of communities in the vicinity of Federal lands that are at high risk from wildfire.

FS Manual 5100: Provides direction on wildland fire including suppression and fuels management, including prescribed fire in general and within wilderness.

FS Handbook 5109: Provides direction for wildland fire managers.

National Fire Plan, August 2000: Outlines a plan of action for Federal agencies in order to protect wildland urban interface and be prepared for extreme fire conditions.

Federal Wildland Fire Management Policy of 1995 (updated January 2001): Guides the philosophy, direction, and implementation of wildland fire management on Federal lands.

2002 President's Healthy Forests Initiative: Emphasizes administrative and legislative reforms to expedite fuels treatments and post-fire rehabilitation actions.

Interagency Prescribed Fire Planning and Implementation Procedures Guide 2017: Provides standardized procedures, specifically associated with the planning and implementation of prescribed fire.

Guidance for Implementation of Federal Wildland Fire Management Policy 2009: Guidance for consistent implementation of the 1995/2001 Federal Fire Policy.

National Cohesive Wildland Fire Management Strategy 2014: A strategic document to work collaboratively among all stakeholders and across all landscapes, using best science, to make meaningful progress towards three goals: 1) Restore and Maintain Landscapes; 2) Fire Adapted Communities; and 3) Wildfire Response.

Interagency Standards for Fire and Fire Aviation Operations 2018 (NFES 2724): A reference guide that documents the standards for operational procedures and practices for the Forest Service fire and aviation management program.

Key Indicators and Measures

- Future wildfires and fire regimes as measured by projected acres of wildfire and severity class within potential vegetation type.
- Future fuels treatments as measured by acres of projected mechanical treatments and prescribed fire.
- Flexibility for fire management as measured by the acres of land allocations that influence the flexibility to carry out mechanical and prescribed fire treatments and manage unplanned natural ignitions.

Methodology and Analysis Process

Fire is a primary natural disturbance process within the Custer Gallatin ecosystems that changes vegetation conditions. Fuels management consists of management activities designed to alter vegetation conditions to achieve desired results. Therefore, the analysis process for determining vegetation conditions, past, present, and future provides the basis for the analysis of fire and fuels treatments within this section of the environmental impact statement. While described briefly here, please refer to the vegetation section for greater detail.

The vegetation management strategy for the Custer Gallatin is to manage the landscape to maintain or trend towards vegetation desired condition. Modeling was used to estimate extent and effects of disturbance processes, such as fire, to develop a natural range of variation to project future wildfire. Fire (planned and unplanned), insects (such as, bark beetles), disease (such as, root disease), weather events (drought, windthrow), and harvest treatments are the main drivers of vegetative change, interacting with climate, and the process of vegetative succession. The main analytical models used were the SIMPPLLE model (SIMulating Patterns and Processes at Landscape scaLEs) (Chew et al. 2012b) and the (Plan-level foRest actIvity Scheduling Model) PRISM model (Plan-level foRest actIvity Scheduling Model) (Nguyen 2018).

The SIMulating Patterns and Processes at Landscape scaLEs and PRISM models are used in the forest plan revision, for details refer to the terrestrial vegetation report and appendix B. The analysis assumes climate trends will continue to be warmer and drier than historical conditions, naturally ignited wildfire will continue to be the largest contributor to fuels management and development in the wildland urban interface will continue (IPCC 2007). Additionally, under warmer and drier conditions, it is anticipated that large fire activity will continue to increase in the future (Westerling et al. 2011, Barbero et al. 2015) and that fire seasons will be longer than historically observed (Yue et al. 2013).

Naturally ignited wildfire will continue to be the largest contributor to fuels and vegetation management (FIRESTAT data, (FACTS) data) and the use of wildland fire as a tool may occur on all acres in all alternatives. Prescribed fire and other vegetation treatments will continue to contribute to fuels management as budgets and conditions allow.

With continued development in the wildland urban interface, boundaries identified in Community Wildfire Protection Plans will also change over the life of the plan, as there will be an increased need to focus fuels treatments in these areas. An increase in human caused ignitions is associated with increased wildland urban interface (Syphard et al. 2007).

Information Sources

This analysis also draws upon the best available literature citations that were found to be relevant to the ecosystems on the Custer Gallatin. Literature sources that were the most recent, peer-reviewed, and local in scope or directly applicable to the local ecosystem were selected. Uncertainty and conflicting literature was acknowledged and interpreted when applicable. In addition, local studies and anecdotal information that is not peer-reviewed is included where appropriate to provide context.

Best available information was used to build the fire suppression logic and assumptions within the SIMPPLLE and PRISM models, including corroboration with actual data and professional experience and knowledge. The terrestrial vegetation section provides a detailed discussion on model development and outputs associated with fire and resulting vegetation changes (appendix B).

The historic fire occurrence and fire size data used for calibrating fire probabilities in the SIMPPLLE and PRISM model were derived from multiple sources. Forest fire occurrence data were gathered from the FIRESTAT database for fire ignition point data. Next, large fire polygons where obtained from Custer Gallatin spatial records and the Forest Activity Tracking System (FACTS) database. Fire severity data was taken from Monitoring Trends in Burn Severity (MTBS) data, which uses only fires greater than 1,000 acres. This analysis did not include unburned acres or areas of increased greenness within fire perimeters.

Analysis Area

The analysis area for the fire and fuels management effects include the lands administered by the Custer Gallatin National Forest as well as lands of other ownership, both within and adjacent to the national forest. The temporal scope of the analysis is the anticipated life of the plan with some analysis occurring across the longer term (50 years), consistent with the analysis period for other key ecosystem characteristics associated with the terrestrial vegetation.

3.7.2 Affected Environment (Existing Condition)

Natural Fire Regimes and Natural Range of Variation

A fire regime represents the periodicity and pattern of naturally occurring fires, described in terms of frequency, biological severity, and aerial extent (Anderson 1982). The natural fire regime is a classification of the role fire would play across a landscape in the absence of modern human intervention, but including the influence of aboriginal fire use. Five natural fire regimes are classified based on the average number of years between fires (fire frequency or mean fire interval) combined with severity (the amount of vegetation replacement) and its effects to the dominant vegetation (National Interagency Fuels 2010) (table 46).

Table 46. Fire regimes, vegetation types, and acres and percent distribution on the Custer Gallatin (Landfire 2010, v.1.2.0)

Fire Regime[1]	Definition1	Existing Vegetation Types[1,2]	National Forest System Acres[3]	Percent of Landscapes
I	0- to 35-year frequency; non-lethal, low / mixed severity	Ponderosa pine; dry Douglas-fir; deciduous woodland draws/ravines	216,324 – Pine savanna 124,847 - Montane	32% - Pine savanna 5% - Montane
II	0- to 35-year frequency; replacement (high severity)	Grasslands; mixed grass pine savannas; mountain big sagebrush; Great Plains shrublands	387,267 - Pine savanna 43,070 - Montane	57% - Pine savanna 2% - Montane
III	35- to 200-year frequency; mixed / low severity	Wyoming big sagebrush; low sagebrush; riparian systems (cottonwood); limber pine / Rocky Mountain juniper; dry lodgepole pine; moist Douglas-fir; whitebark pine	34,288 - Pine savanna 973,770 - Montane	5% - Pine savanna 35% - Montane
IV	35- to 200-year frequency; replacement (high severity)	Aspen; moist lodgepole pine; subalpine fire, Engelmann spruce	38,660 - Pine savanna 251,146 - Montane	6% - Pine savanna 9% - Montane
V	Greater than 200-year frequency; any severity	Poor-site lodgepole pine; subalpine forbs and grasses; whitebark pine	0 - Pine savanna 1,105,911 - Montane	0% – Pine savanna 40% - Montane
Sparsely Vegetated	National Land Cover database (NLCD) class	N/A	1,579 - Pine savanna 170,718 - Montane	< 1% - Pine savanna 6% - Montane
Barren	NLCD Class	N/A	2,019 - Pine savanna 72,135 - Montane	< 1% - Pine savanna 3% - Montane
Snow/Ice	NLCD class	N/A	0 - Pine savanna 7,226 - Montane	0% - Pine savanna < 1% - Montane
Water	NLCD class	N/A	114 - Pine savanna 24,420 - Montane	< 1% - Pine savanna < 1% - Montane

1. Table information is adapted from (National Interagency Fuels 2010).
2. Vegetation types are not the same as existing vegetation types discussed elsewhere in this chapter.
3. Acre summaries in this section may differ slightly due to the data source (raster data versus vector GIS data)

As described in the Assessment Fire and Fuels report (Shea 2017), figure 13 displays the current and desired average acres burned per decade by potential vegetation type and severity. The Custer Gallatin is generally on the low end of the natural range of variability for acres burned with a pronounced fire deficit in low severity fire in the warm dry pine savanna and mixed severity fire in the warm dry montane.

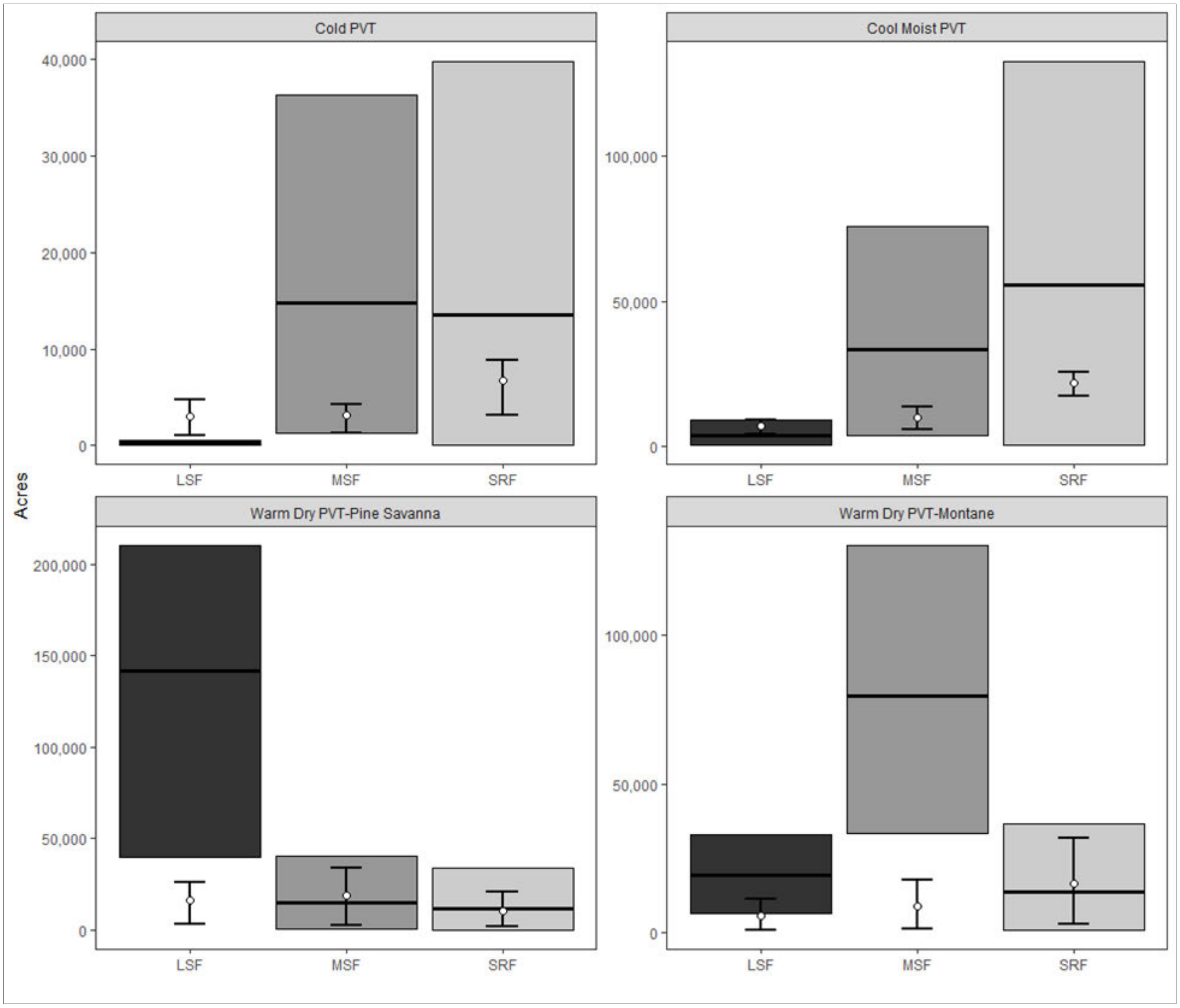

Figure 13. Current and desired average acres of fire per decade (LSF = low severity fire MSF = mixed severity fire SRF = stand replacing (high severity) fire)

The large bars in the figure are the modeled natural range of variability of decadal acres, based on data from SIMPPLLE (see appendix B for further detail). The points, with 90 percent range of variability bars, represent the current condition, which is average decadal acres burned (fires greater than 1,000 acres) from 1986 to 2015, based on data from Monitoring Trends in Burn Severity.

Recent Wildfire History and Trends

Fire data in the Custer Gallatin's geographic information system database shows wildfire areas burned since 1940. In this dataset, the earliest records may not be complete and often include only large fires or active fire years, creating the potential to underestimate the quantity and extent of older fires. The data are based on fire start records on National Forest lands, and do not include ignitions that went out prior to being detected.

Historically, large fires have occurred across the Custer Gallatin National Forest, as shown by fire history studies (Barrett et al. 1997), recent data (1940 to present), and anecdotal evidence (pre-1940). The Custer Gallatin Assessment Fire and Fuels Report contains additional information on fire history.

The trend of large fires decreased between the 1940s and 1980s and then increased again starting in 1988 (see figure 14) (FIRESTAT data). This cycle has many influences, including fuels, weather (daily, monthly, and long term), ignition sources, and suppression efforts. The lull in the cycle is likely the combination of cooler climatic conditions (Littell et al. 2009a), reduced fuels from the earlier high fire cycle (pre-1940), the increasing capability of technology (such as, air tankers, dozers), and agency focus on suppression. Recent increases in large fires also can be attributed to climate change (Abatzoglou and Williams 2016), changes in national wildland fire policy since 1980, the recognition and implementation of the role of fire on the landscape, and the integration of the changing policy into the management of the Custer Gallatin wildfire program. Despite the overall trend in increased acreage, the northern Rocky Mountains are still experiencing a fire deficit, where acres burned historically have been less than what is expected and with longer fire rotations (Parks et al. 2015b).

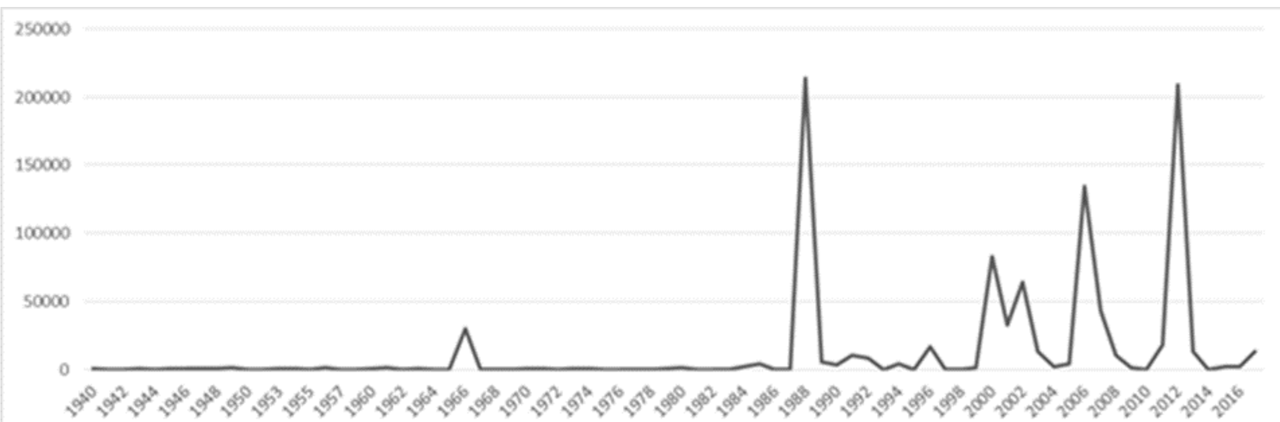

Figure 14. Total acres burned, Custer Gallatin National Forest, 1940 to 2017; includes all acres within wildfire perimeters

Recent wildfire history is shown in figure 15, which displays the acres of large fire (greater than 1000 acres in size) that have occurred on the Custer Gallatin over the past 30 years (Monitoring Trends in Burn Severity data).

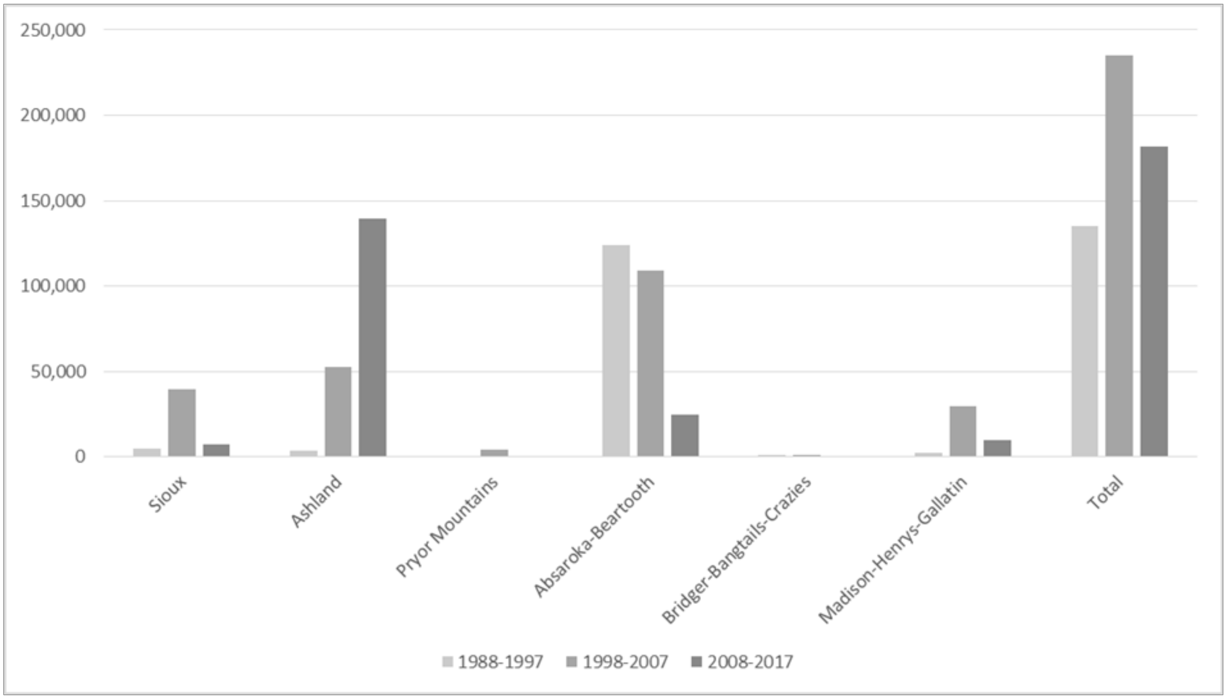

Figure 15. Large wildfire acres (larger than 1,000 acres) burned by geographic area, Custer Gallatin National Forest, 1988 to 2017 (does not include unburned areas within wildfire perimeters)

In the pine savanna landscapes, acres burned by decade from large fires have increased since 1988. The increase in burned area may be in part due to fuel buildup caused by fire exclusion and the influence of a warm/dry climate on vegetation, fire behavior, and effectiveness of suppression. The increase in acres burned is consistent with other observations in the northern Rocky Mountains. Alterations in fire regimes due to climate changes (Westerling et al. 2006) and human caused climate change have accounted for half of observed increases in fuel aridity (Abatzoglou & Williams, 2016) and increases in wildland fire frequency over the last twenty years. Almost 95 percent of recorded fire ignitions are by lightning (FIRESTAT data).

In the montane landscapes, acres burned by decade from large fires have decreased since 1988, but this is not an indication that this trend will continue as it is predicted that large fires will be more common in the future (Westerling et al. 2011). The majority of these landscapes are in mixed to high severity fire regimes where wildfires need the right conditions to become large and are driven by topography, climate, and extreme wind events (Rollins et al. 2002, Schoennagel et al. 2004, Keyser and LeRoy Westerling 2017). Almost 70 percent of recorded fire ignitions are by lightning (FIRESTAT data).

Across the Custer Gallatin National Forest as a whole, from 1940 to 2016, lightning accounted for 74 percent of recorded ignitions (FIRESTAT data), but is highly variable (figure 16). The Custer Gallatin annually manages approximately 93 percent of all natural ignitions with control, confine, and point-protection strategies and has managed naturally ignited fire as a natural process exclusively within the designated Absaroka-Beartooth Wilderness and the Lee Metcalf Wilderness since the early 1990s.

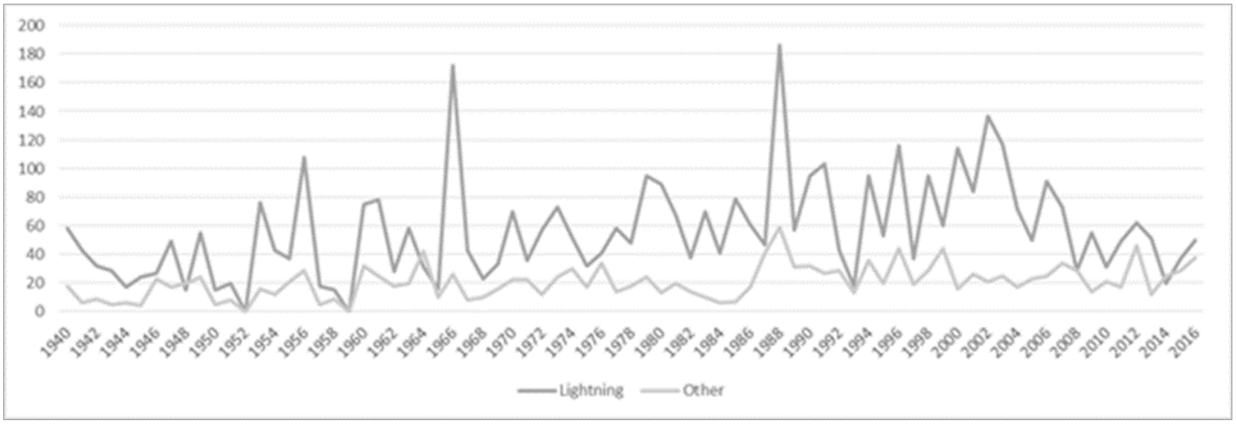

Figure 16. Number of starts of lightning-caused and human-caused fires, Custer Gallatin National Forest, 1940-2017

Climate Change

Of all of the ongoing and foreseeable future actions that have the potential to affect fire, especially unwanted wildfire, climate change is likely to be the single most important factor. In general, the fire seasons are expected to become longer, large wildfires are expected to occur more often, and total area burned is expected to increase (J. E. Halofsky et al. 2018). A recent comprehensive synthesis of the science surrounding climatic change and ecosystems concluded that all fire regimes in Montana forest ecosystems would experience some increase in fire risk (Whitlock et al. 2017). More fires would also occur in all forests because of longer fire seasons and higher human populations (Vose et al. 2012). There is also evidence that increasing drought could lead to decreased post-fire tree regeneration, conversion to non-forest vegetation types, and decreased resilience (Harvey et al. 2016b, Stevens-Rumann et al. 2018).

Fire intensity and severity would probably be higher in low severity fire regimes because of fuel drying from hotter temperatures and higher fuel loadings (that is, tree mortality, increased forest densities). In mixed severity fire regimes, an increase in fire risk is projected with short-term increases in fire severity and could convert lands to more of a low severity fire regime, where frequent fires favor more open stand conditions and tree species resistant to fire damage. Increased fire risk and fire sizes in high severity fire regimes are projected to increase with no change in severity (Rocca et al. 2014) and could have significant local effects, especially in the wildland urban interface.

3.7.3 Environmental Consequences

Current Plans

Management Direction under the Current Plans

The current Custer and Gallatin forest plans, as amended, are the existing management direction being used by the Custer Gallatin to address fire and fuels management. However, because the current plans are the baseline to which the revised plan alternatives are compared, it is important to understand what actions would continue under the current plans.

The 1987 Gallatin National Forest Plan, as amended, includes the following forest-wide standard: One or more fire management strategies may be considered and implemented for any unplanned wildland fire to achieve a variety of resource management objectives, while minimizing negative effects to life, investments and valuable resources. It also allows for the use of planned, prescribed fire to achieve resource objectives throughout all management areas as provided in the 1987 forest plan. Mechanical treatments are not allowed in management area 4 (wilderness and recommended wilderness).

The 1986 Custer National Forest Plan, as amended, allows for the forestwide use of all management response options for wildfire (control, contain, confine). Exceptions are for management area F (developed recreation sites) and management area P (administrative sites), where control is the only option, and management area E (energy and mineral production), management area M (riparian areas), management area N (woody draws), and management area O (National Natural Landmarks), where contain and control are the only options. Prescribed fire is allowed forest-wide except in management area H (recommended wilderness) and management area O (National Natural Landmarks). Mechanical treatments are allowed forest-wide except in management area I (wilderness) and management area L (research natural areas).

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

All revised plan alternatives contain the same desired conditions and guidelines that articulate what role fire should play. Management direction recognizes that risks to important values change depending on seasonal changes in weather and fuels, providing the opportunity to use fire as a management tool when conditions are conducive to meeting various plan objectives. The revised plan continues to recognize that with certain weather, fuels, and topography, fires can be managed with minimal risk to values.

The plan objective for a minimum of 375,000 acres per decade of natural unplanned wildfire is based on the assumption that wildfire acres would double in the coming decades relative to the previous 30 years as described in appendix B. This acreage is for all vegetation types, is on the low to moderate spectrum of the natural range of variation (figure 13) and is consistent with model outputs.

In the revised plan, all management response options are available to use for unplanned fires, forest-wide. Prescribed fire is also allowed forest-wide. Mechanical treatments are allowed forest-wide, but will be limited in designated wilderness, Hyalite-Porcupine-Buffalo Horn Wilderness Study Area, recommended wilderness and Cabin Creek Wildlife Management Area. The acres of each designated area, specifically recommended wilderness, influence how fire management can be implemented for each alternative.

All Alternatives

Effects Common to all Alternatives

Future Fuels Treatments

All alternatives contain objectives for treating vegetation, through wildland fire and mechanical treatments, to improve structure and composition. This includes reducing surface fuels, ladder fuels, and canopy density in order to reduce fire intensity.

Prescribed fire is essential to reducing fuels; (Reinhardt et al. 2008) found that it is possible to craft treatments to achieve both ecological restoration and fire hazard reduction. However, ecological restoration will also include reintroducing fire and other active management; the most effective ecosystem treatments should include prescribed fire. Prescribed fire on the landscape in all alternatives would be expected to partially offset predicted effects from climate change (Wiedinmyer and Hurteau 2010).

Flexibility for Fire Management

Key considerations for fire management are described in this section. A large number of burnable acres of National Forest lands that cannot be actively managed by mechanical means. Additionally, mechanical treatments in designated wilderness is limited (except as necessary to meet the minimum needs for protection and administration of the area as wilderness). Administrative use of motorized equipment is allowed in Wilderness Study Areas and in recommended wilderness. Appropriately managing wildfire in places with an opportunity to obtain resource benefits and a low risk of potential damages may be the only way in many areas to increase the pace and scale of ecosystem restoration activities. Informed management of wildfire would also be needed to maintain areas once restoration has occurred. Wildland fire also exhibits self-regulating effects, in which a burned area will act as a fuel break and reduce the probability of subsequent fire spread (Parks et al. 2018). This effect is dependent upon many factors, including vegetation type, previous burn severity, and climate, but can be reduced by climate-induced extreme weather events (Parks et al. 2015a) which are predicted to be more common in the future (Westerling et al. 2011).

The alternatives vary from the fuels management perspective on the allocation of acres and different designated areas; the primary designated area that impacts fuels management is recommended wilderness. Other management limitations apply to all alternatives. In inventoried roadless areas, which comprise the majority of recommended wilderness areas, there are limitations on road construction and timber cutting, relating to the purpose and location of treatments in relation to identified wildland urban interface (wildland urban interface). Additionally, the implementation of the Northern Rockies Lynx Management Direction (U.S. Department of Agriculture, Forest Service, 2007) constrains treatments in lynx habitat outside the wildland urban interface where multi-storied hare habitat or stand initiation hare habitat is present.

The use of prescribed fire within the wildland urban interface (wildland urban interface) is a high-risk action and is often more expensive than prescribed fire in the non-wildland urban interface. This is due to the extra steps taken to ensure public safety and mitigate hazards to private property. Additionally, impacts from smoke emissions adjacent to homes for extended periods limit the number of acres that can be treated. Within the wildland urban interface, there is an increased need to rely on mechanical and hand treatments rather than fire. In addition, social issues (for example, effects of treatments on scenery, air quality, noise, and wildlife viewing) can be more contentious.

Future Wildfires and Fire Regimes

Natural, long-term variations in temperature and precipitation patterns have resulted in continuously changing fire regimes (Whitlock et al. 2008), and thus continually changing forest conditions. This past climatic variability has had major effects on the timing, frequency, intensity, severity, and extent of wildfires, as would future changes in climate. The effect may be due to direct climate-related factors, such as increased temperature and greater drying of forest fuels; or indirectly, related to potential changes in forest composition and structure due partly to climate change. These climate-induced changes in fire regimes could have substantial impacts on ecosystems, with associated effects to communities and economies (Littell et al. 2009b).

Wildfire has been and will be the greatest driver of vegetation change on the Custer Gallatin National Forest (FIRESTAT data, FACTS data) and under all alternatives, natural unplanned wildfire would be allowed to play its ecological role, although less so under the current plans. Along with prescribed fire, use of wildland fire will help in alleviating the fire deficit (Parks et al. 2015b, Vaillant and Reinhardt 2017) as well as providing many ecological benefits. Climate effects (J. E. Halofsky et al. 2018a,b) as well as plan components that encourage the ecological role of fire will increase the amount of wildfire on the landscape under all revised plan alternatives. The increased use of unplanned ignitions in the revised plan alternatives would lead to greater fuels reduction and forest vegetation would be restored to more resilient conditions, which could mitigate climate change effects (Parks et al. 2016a).

Simulation modeling (SIMPPLLE) was used to estimate wildfire activity on the Custer Gallatin National Forest for five decades into the future. Best available information was used to build the fire suppression logic and assumptions within the model, including corroboration with actual data, and professional experience and knowledge. Refer to appendix B for detailed discussion on model development and outputs. The model predicts that wildfire will continue to a similar degree under all alternatives, which equates to an average of approximately 250,000 acres per decade in forested vegetation types. The similarity across all alternatives is due to both natural and human caused ignitions, an expansive fuel source and climate effects. It cannot be predicted with high accuracy where and when fires will occur. There is also a high degree of variation, spatially and temporally, in the amount and location of fire.

Effects that Vary by Alternative

Future Fuels Treatments

In all alternatives, prescribed fire would continue to be used to move the Custer Gallatin National Forest toward desired future conditions. The amount of anticipated prescribed fire within forested areas varies by alternative (table 47). The current plans and alternatives B and C are projected to result in similar acres being treated with prescribed fire. Alternative D would result in more treated acres, consistent with the theme of this alternative. Alternative E is projected to result in the least amount of prescribed fire within forested vegetation types, due to an emphasis on timber production. Additional potential treatments in non-forested vegetation types are not reflected in the projections.

Table 47. Average decadal prescribed fire acres over 5 decades, by alternative

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
27,645	28,093	28,093	38,011	24,085

Acres are from the PRISM model and only include forested areas. Non-forested area is not included in these figures. Figures include areas both inside and outside the wildland urban interface

Harvest treatments can also be used to achieve fuel management objectives, such as reducing forest densities and favoring fire-resistant species, but effectiveness is dependent upon harvest type (Hartsough et al. 2008). Relative to impacts to fire and fuels, treatments that may occur in the wildland urban interface may be the most important for protecting values at risk. Each alternative results in differing amounts of projected harvest treatments inside the wildland urban interface, as shown in table 48. The current plans, alternative B, and C treat similar amounts of the urban interface where alternative D treats more acres. Alternative E treats less as a result of maximizing timber production which would harvest larger trees on fewer acres. Alternative E emphasizes harvesting in high productivity forests, whereas the current plans, alternative B, C, and D focus treatments on dry vegetation sites that are most departed from desired conditions. Alternative E would be the least responsive in obtaining desired fuel conditions within the wildland urban interface.

Table 48. Average decadal prescribed fire acres over 5 decades, by alternative

Current plans	Alternative B	Alternative C	Alternative D	Alternative E
18,426	17,304	17,725	21,984	15,156

PRISM model, average acres per decade, all harvest types, projected to occur in the wildland urban interface.

Flexibility for Fire Management

The alternatives vary from the fuels management perspective on the allocation of acres to different designated areas. The primary designated area that impacts fuels management is recommended wilderness due to limitations on mechanical treatments. However, most recommended wilderness areas are inventoried roadless areas, which would already limit mechanical treatments due to constraints on road building and access. This is most important where recommended wilderness overlaps with wildland urban interface (wildland urban interface), where it is assumed that the majority of fuels mitigation would occur. Due to the objectives of fuels treatments, such as reducing canopy density and ladder and ground fuels, fuels treatments in the wildland urban interface would produce vegetation structure that is most likely not compatible with wilderness characteristics, especially in higher elevation vegetation types. Due to this constraint, wildland urban interface mechanical fuels treatments within recommended wilderness would be very limited as they would not meet their purpose and need and could be ineffective.

Within recommended wilderness, wildfire would primarily be used to meet resource objectives, with less emphasis on mechanical treatments and prescribed fire. However, fuel management would be dependent upon the use of unplanned ignitions and the risk assessment associated with each season and event that may require suppression actions instead. Due to constraints on mechanical treatments, there would be limited opportunities to pretreat areas that would serve as buffers for naturally ignited wildfires and the ability to use wildfire for resource benefit would likely be reduced. Additionally, the location of the ignition would weigh heavily on decisions relating to suppression.

Table 49 displays the total amount of recommended wilderness by alternative and the acres of recommended wilderness that occur within the wildland-urban interface.

Table 49. Recommended wilderness acres and wildland-urban interface by alternative

Area of Recommended Wilderness and Wildland urban interface in Recommended Wilderness	Current Plans	Alternative B	Alternative C	Alternative D	Alternative E
Acres Recommended Wilderness	33,741	113,952	146,555	711,425	0
Acres of wildland urban interface in Recommended Wilderness (% of RWA)[1]	3,373 (10)	8,937 (7.84)	14,374 (9.8)	154,846 (21.77)	0 (0)

1. Using HFRA wildland urban interface definition. Wildland urban interface will change over time as population growth continues; these values are current as of the date of this report

Alternative B would have more acres of recommended wilderness compared to the current plans. Of all of the revised plan alternatives, alternative B has the least amount of acres and percentage of acres in wildland urban interface at 7.84 percent. For comparison, designated wilderness has 5.46 percent of its acres in wildland urban interface.

Alternative C would be similar to alternative B except there would be more acres of recommended wilderness, more acres in wildland urban interface and a higher percentage of acres in wildland urban interface. This may result in reduced flexibility for unplanned natural ignitions used to meet forest plan desired conditions.

Alternative D has the greatest amount of recommended wilderness and the greatest percentage of recommended wilderness in the wildland urban interface. Based on land allocations, this alternative provides for the least flexibility for fire management, resulting in the fewest opportunities of mechanical fuels treatments within recommended wilderness. With less flexibility in conducting associated fuel management activities, unplanned natural ignitions may require suppression actions and desired conditions may not be met.

Alternative E provides for the most flexibility for fire management by including no recommended wilderness, resulting in the greatest opportunities for mechanical treatments and prescribed fire, which could lead to more opportunities to effectively use natural unplanned fires for desired conditions.

Consequences to Fire and Fuels Management from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Air Quality Management

The consequences to fire from air quality are the same for all alternatives. All alternatives have the same plan components to meet air quality standards established by Federal and state agencies. The Forest Service would meet the requirements of state implementation plans and smoke management plans. Laws and regulations on smoke emissions can limit opportunities to conduct prescribed burning. These limitations are most frequently encountered in high population density areas.

Effects from Timber Management

Consequences from timber management are generally the same for all alternatives in that timber management direction complements fuels management by reducing fuel loads and increasing resilient landscapes. Vegetation treatments are typically designed and implemented to achieve multiple resource, social and economic objectives, including those associated with fuels management. However, there are some differences by alternative that affect the location of treatments. The current plans, alternatives B, and C have a similar amount of timber harvest that is well-balanced with fuels management. Alternative E will see a reduction in fuels treatments due to focus on timber production, and the timber harvest areas that could also see fuel reduction benefits won't necessarily be in the most strategic location for fire management. Timber management will have the least effect under Alternative D, where the focus will not be on timber production. All alternatives also recognize that not all fire is detrimental to timber production. Therefore, there is opportunity to allow wildfires to burn and help maintain/restore fire adapted ecosystems.

Effects from Watershed, Soil, Riparian, and Aquatic Management

Plan components recognize that wildland fire, along with mechanical fuels treatments, will play a key role in maintaining and restoring watersheds and riparian ecosystems. Consequences from these components would be generally similar for all alternatives. However, in order to meet the plan direction associated with these resources there could be occasions where prescribed fires or mechanical treatments cannot be used if there are potential negative effects to aquatic and riparian-associated resources. Fuels management activities occasionally require some soil disturbing activities or road construction, which may be limited to meet other plan components. Although it is difficult to quantify the effects, all the alternatives have components that would limit fire or fuels treatments for ecosystem maintenance or restoration.

All alternatives would contain components that limit equipment use on steep slopes. However, the revised plan alternatives also include guidelines that require a minimum amount of organic matter to be present following treatments, which may be difficult to achieve following prescribed fire in some cases. The revised plan alternatives also contain guidelines for the retention of snags and coarse woody debris, which would also factor in to prescribed burning prescriptions. Finally, the revised plan alternatives include the adoption of riparian management zones, which are greater in size from the riparian zones currently identified for streams east of the Continental Divide. The plan components associated with riparian management zones would also influence fuels treatments and fire suppression actions to ensure minimal impacts and ecological benefits.

In summary, all alternatives include plan components for the protection of water, soil, and aquatic resources. The components for the revised plan alternatives (B, C, D, and E) are more specific and potentially limiting to fuels treatments than those in the current plans.

Effects from Wildlife Management

In general, wildlife management direction has low impact on fire and fuels management, especially within the wildland urban interface, because management direction recognizes the importance of managing vegetation to modify fire behavior. Fire on the landscape is also an important part of the natural function of the ecosystem, and as such, helps create and maintain habitat conditions for native wildlife species.

Specific plan components for wildlife may limit fuels management activities. For example, all alternatives include plan components that would limit disturbance to some species during critical times, such as nesting or calving, in specific areas. These species include raptors, bats, and ungulates. Such timing restrictions may result in missed prescribed fire windows at times. There are also plan components that specify habitat conditions such as thermal cover, security, or hiding cover for species such as elk, although hazardous fuels projects are generally exempt from these guidelines.

All alternatives would adopt the Grizzly Bear Conservation Strategy (U.S. Department of the Interior, 2016). Associated plan components that would require secure habitat to be maintained may limit access, and thus treatments such as prescribed burning, within the Greater Yellowstone Ecosystem Primary Conservation Area. This would apply to the Absaroka Beartooth and Madison, Henrys Lake, and Gallatin geographic areas.

In addition, there are plan components that specify how sage-grouse habitat should be preserved and restored which would affect the Ashland and Sioux geographic areas. In order to achieve no net loss of habitat, prescribed fire would be limited in general and priority sage-grouse habitat. Fuels treatments that would allow removal of invading conifers would be allowed.

The Northern Rockies Lynx Management Direction (U.S. Department of Agriculture 2007) would be implemented under all alternatives. This direction recognizes the importance of fuel treatments within the wildland urban interface as designated by the Healthy Forest Restoration Act. However, opportunities to conduct vegetation treatments, including prescribed fire or mechanical fuels reduction treatments, outside the wildland urban interface are limited under current lynx management direction. Restrictions on treating within these forest conditions is likely to reduce the ability and effectiveness of achieving desired forest and fuel conditions outside the wildland urban interface.

Lynx management direction restrictions on treatments in multi-story hare habitat and young seedling/sapling forests have the most impact. These forest conditions affect 10 to 20 percent of the forested cover types in the Custer Gallatin and consist of subalpine fir-spruce forests. Fire is the primary natural disturbance process that creates areas of seedling/sapling forest. Thinning of dense sapling stands is typically designed to create future forests composed of larger trees and desired species (such as fire resistant Douglas fir). These forests are more resilient in the face of future wildfire events, and may burn less severely, reducing potential future impacts to values at risk. Thinning in these young stands is generally not allowed under lynx management direction.

Treatments in multi-story forests hare habitat, which would result in it no longer qualifying as multi-story hare habitat, are also not allowed outside the wildland urban interface. This includes both mechanical (for example, harvest) and prescribed burn treatments. Typically, the objective of prescribed fires is to reduce stand densities by removal of the understory, and in some forest types (such as subalpine fir and lodgepole-dominated forests), removal of portions of the overstory to create patches of more open forest conditions across the landscape. Prescribed fire management with these objectives would not be able to occur in multistory hare habitat, limiting the ability to manage landscape patterns and fuel conditions to achieve desired conditions. Use of wildfire (unplanned ignitions) to achieve desired conditions is allowed for the purposes of restoring ecological processes and maintaining and improving lynx habitat.

Effects of Land Allocations for Backcountry Areas

Backcountry areas could result in reduced flexibility and options for vegetation and fuels management to achieve desired conditions, depending on alternative. The ability to use unplanned ignitions (wildfire) as a tool would be very limited within some of the backcountry areas due to proximity to the wildland urban interface. This is because of the small size and/or in locations that likely have to be aggressively suppressed to protect identified values (for example, private lands). Building new roads in support of fuels management activities would also not be allowed, which would limit access. These effects would be most pronounced under alternative C, with some impact, though much less, under alternative B. There would be little impact under alternative D. Current plans, where backcountry areas are classified as Low Development Areas, and Alternative E, would see no effect as all backcountry areas are already classified as inventoried roadless areas.

Effects from Scenery Management

Under all alternatives, the forest plan scenic integrity objectives do not outright prohibit on-the-ground actions. However, it may influence the design or the location of on-the-ground fuels projects that would be visible from any of the listed critical viewing platforms. Design features or mitigations may be required to meet or exceed the assigned scenic integrity objective, which describes the maximum threshold of visual dominance and deviation from the surrounding scenic character.

The forest plan scenic integrity objectives also do not affect unplanned ignitions under all alternatives. Wildfires are a natural process that has altered vegetation for millennia and the ecological context of these disturbances are considered part of the Custer Gallatin's natural scenic character.

Effects from Permitted Livestock Grazing

In all alternatives, livestock grazing would occur on portions of the Custer Gallatin National Forest. Plan components would enable grazing activities to complement fire and fuels management, such as reducing fine fuels to lower fire risk. However, grazing can alter grassland and shrubland fire regimes through soil disturbance, increased competition from non-native annual grasses, and reduction in fine fuels (Knick et al. 2005). Duration and intensity of grazing could affect prescribed fire implementation by reducing available fuels. Location and timing of grazing could also affect prescribed fire implementation by restricting available burn units. Coordination with affected grazing allotment permittees should occur for all fuels treatments in order to meet objectives.

Cumulative Effects

Human Population Increases and Shifts towards Wildland-Urban Interface

More human development is occurring near the boundary of lands administered by the Custer Gallatin National Forest. This trend is expected to continue in the future and is likely to have effects on the forest vegetation. The need for vegetation treatments being implemented within wildland urban interface (wildland urban interface) areas will increase. The objective is to reduce hazardous fuels, as well as having fewer vegetation treatments being conducted in areas located away from communities. In addition, the types of fuel treatments used in the wildland urban interface are often more expensive than methods elsewhere, and the social issues (for example, the effects of treatments on scenery, air quality, noise, wildlife viewing, etc.) can be more contentious. Therefore, higher public involvement, planning, and implementation expenses are likely to lead to fewer acres being treated within a given budget level. Fire managers' ability to implement prescribed burns will lessen in the wildland urban interface due to plan components (such as those related to soils and wildlife). Despite efforts to suppress human-caused fires, these types of fires are more likely (which could have effects on the forest vegetation) in the wildland urban interface as more people live and recreate in the area.

The wildland urban interface has become the focus of wildland fire suppression resources. The future increase in the wildland urban interface will continue to challenge wildfire management during large fire events as "Firefighters will likely have to protect dispersed housing over an extremely large area of fire-prone forest." (Gude et al. 2008). To work individually with property owners is costly and creates a patch work of defendable properties among those that are not. Over the last 26 years the number of homes being built in high wildfire hazard areas has doubled in Montana (Pohl 2018) which will add to the protection problem at the local level.

Relative to current levels, more wildfire in the future is expected and policies that foster adaptive resilience in the wildland urban interface (wildland urban interface) are needed (Schoennagel et al. 2017). Building homes with fire-resistant materials and landscaping that will reduce ignitability and result in fire-resilient properties, able to withstand future fires (Cohen 2000). This is consistent with goal 2 of the National Cohesive Wildland Fire Management Strategy; creating fire adapted communities, which is primarily the responsibility of private landowners, local and state governments. While the Forest Service cannot directly engage in any private structural fire strategy, tactics are used to prevent a wildland fire from reaching private structures (U.S. Department of Agriculture, Forest Service, 1991). The other two goals of the National Cohesive Wildland Fire Management Strategy are for restoring and maintaining landscapes and wildfire response, which is the focus of forest service fire and fuels management. By working together across boundaries; all three goals can come together to better facilitate managing wildland fire on the landscape in closer proximity to the wildland urban interface.

Increased Regulation and Concern over Smoke Emissions

The ability to use fire to maintain and restore the fire-adapted ecosystems on the Custer Gallatin National Forest, or to use fire to reduce hazardous fuels in the wildland urban interface, is dependent upon air quality regulations. As air quality regulations become stricter, the ability to use fire as a management tool becomes limited. If past trends of increasing regulations and decreasing burn opportunities continue, the effects would likely result in not being able to use fire enough to make meaningful improvements to forest and fuel conditions and meet objectives.

Timber Product Manufacturing Infrastructure and Economics

The ability of the Custer Gallatin to positively affect forest vegetation is partially dependent upon the ability to sell forest products to manufacturing companies and to use harvesting process (including the residual slash disposal activities) as a means to positively affect the forest vegetation and reduce hazardous fuels. If the forest products industry declines in areas surrounding the Custer Gallatin to the degree that it is difficult to sell forest products, or if "stumpage prices" decrease substantially, it would affect how many acres could be treated. While some treatments could be accomplished by using prescribed burning only, it is generally very risky in the wildland urban interface and expensive, leading to fewer acres treated.

Other Plans

Since they were developed, national level plans, initiatives, and acts such as the National Fire Plan, Healthy Forest Initiative, Healthy Forest Restoration Act, and National Cohesive Wildland Fire Management Strategy have influenced the vegetation and fuel management programs on the Custer Gallatin National Forest. Therefore, they have had some effects on hazardous fuels and it is anticipated that they will continue to do so for the foreseeable future. In general, these plans have resulted in more vegetation treatments being implemented near wildland urban interface areas with the objective of reducing hazardous fuels, and fewer vegetation treatments being conducted in areas located away from communities. Not only do these plans emphasize the need to reduce hazardous fuels in the wildland urban interface, but they also stress the need to restore the natural fire regimes and forest conditions to the larger national forest landscape. These plans encourage the development of more resistant and resilient forest vegetation that would be less susceptible to large undesirable wildfires and/or insect outbreaks.

Portions of the Custer Gallatin National Forest adjoin other national forests, each having its own forest plan. The Custer Gallatin National Forest is also intermixed with lands of other ownerships, including private lands, other Federal lands, and state lands. Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans in conjunction with the Custer

Gallatin National Forest revised forest plan are summarized below, for those plans applicable to fire and fuels.

The forest plans for National Forest System lands adjacent to the Custer Gallatin include the Helena-Lewis and Clark, Beaverhead-Deerlodge, Caribou-Targhee, and Shoshone National Forests. All plans address fire and fuels and generally speaking, management of fire and fuels is consistent across all national forests due to law, regulation, and policy. The cumulative effect would be that the management of fire and fuels would be generally complementary. This includes specific adjacent landscapes that cross national forest boundaries, such as the Crazy Mountains, the Madison Range, and the Beartooth Plateau.

Other adjacent Federal lands include ownership by the National Park Service, Bureau of Land Management and Bureau of Indian Affairs. The Yellowstone National Park Fire Management Plan (2014) allows for fire to play its natural role in the ecosystem. Broadly, the fire and fuels characteristics in this area are therefore likely similar to the plan components for the Custer Gallatin and would likely complement these conditions. The Bureau of Land Management has Resource Management Plans for lands near the Custer Gallatin which are managed by the Butte (2009), Billings (2015), Dillon (2006), Miles City (2015), and South Dakota (2015) field offices. These plans contain components related to fire and fuels and would therefore likely be complementary to the plan components for the Custer Gallatin. The Bureau of Indian Affairs, Crow Agency Fire Management Plan (2010) has fire management strategies are similar to the Custer Gallatin and would thus be complementary to fire and fuels management.

The Montana Statewide Forest Resource Strategy (2017) and South Dakota Statewide Forest Resource Strategy (2010) guide fire and fuels management on state lands in Montana and South Dakota, respectively. They include many concepts that are complementary to revised plan components for the Custer Gallatin, for example, state direction for suppression of wildfires. While specific desired conditions are not stated in the same terms as the Custer Gallatin, it is likely that some elements such as providing for firefighter and public safety would be similar. State forestlands may be actively managed to a greater degree than national forest system lands, and would likely contribute to achievement of some desired fire and fuels conditions across the landscape. However, management and use of wildfires for ecological benefit on state lands is not encouraged and would lead away from some desired conditions. The South Dakota Forest Resource Strategy also has direction for the use of prescribed fire, however, there is no mention that fire is a necessary ecological process.

Montana's State Wildlife Action Plan and South Dakota Wildlife Action Plan describe a variety of vegetation conditions related to habitat for specific wildlife species. These plans would likely result in the preservation of these habitats on state lands, specifically wildlife management areas. These plans would interact with the Statewide Forest Resource Strategies and the vegetation conditions described would be complementary to the conditions being managed for in the Custer Gallatin revised forest plan.

Some county wildfire protection plans map and/or define the wildland-urban interface. The Forest Service notes that these areas may be a focus for hazardous fuels reduction; other plan components (such as Northern Rockies Lynx Management Direction) have guidance specific to these areas. Managing for open forests and fire adapted species may be particularly emphasized in these areas. Overall, the effect of the county plans would be to influence where treatments occur to contribute to desired vegetation conditions.

Conclusion

Fire is a critical ecological function that plays a central role in providing quality habitat for both plant and wildlife species. All alternatives would ensure fire remains a part of the ecological system and would move the Custer Gallatin National Forest toward desired future conditions. This is achieved through a variety of management actions including wildland fire and mechanical treatments.

Future wildfire and fire regimes: The projected levels of future wildfire, and their subsequent impact on fire regimes, are generally the same across alternatives. This is because vegetation over time is generally the same for all alternatives, and projected future treatments are also similar. Factors such as climate have a greater bearing on vegetation change and potential wildfire activity than active management.

Future fuels treatments: Alternative E would achieve the least amount of fuel reduction and prescribed fire in forested areas, including in wildland urban interface areas due to focusing on maximizing timber harvest. Under the current plans, alternatives B, C, and especially D would tend to treat more dry forest types in wildland urban interface areas. However, other factors affect the number of acres treated to meet forest plan desired conditions relating to fire and fuels management. Some of these factors include budget allocation, climate and seasonal weather variation, and wildfire occurrence. Budget directly affects how much we are able to treat mechanically and with prescribed fire. Climate and seasonal weather variation affect the ability to conduct prescribed burns. Wildfire occurrence activity locally uses personnel and other resources that would be used for implementing mechanical and prescribed fire treatments.

Flexibility for fire management: Different management designations, specifically recommended wilderness, affect where management tools such as mechanical treatments can be used, especially in the wildland urban interface. The current plans and alternatives B, C, and D would all limit mechanical treatment options within recommended wilderness areas, with D having the most area restricted. If these areas became designated wilderness then additional constraints on treatments would exist. Alternative E has the greatest flexibility for fire and fuels management, followed by alternatives B, C, D, and then A (the current plans).

3.8 Carbon Storage and Sequestration

3.8.1 Introduction

The Forest Service recognizes the vital role that our nation’s forests and grasslands play in carbon sequestration. Accordingly, carbon storage and associated climate regulation has been identified as a key ecosystem service provided by the Custer Gallatin. This section of the EIS addresses and compares the existing conditions and expected trends of carbon pools on the Custer Gallatin, specifically the aboveground carbon pool. The potential effects of alternatives are analyzed relative to carbon storage (sequestration) potential.

The current levels of carbon dioxide in the atmosphere far exceed the concentrations found over the past 650,000 years (Ryan et al. 2010b). As a result, global surface temperatures have increased since the late 1800s, with the rate of warming increasing substantially. This warming will have an impact on the earth’s climate, climate variability, and ecosystems (IPCC 2007). Refer to the Terrestrial Vegetation section of this document for a summary of possible climate trends and projections relevant to the Custer Gallatin’s ecosystems. Carbon sequestration is one way to mitigate greenhouse gas emissions by offsetting losses through capture and storage of carbon. The relationship between climate change and other resources is addressed throughout this analysis. This section specifically addresses carbon sequestration.

Regulatory Framework

There are no applicable legal or regulatory requirements or established thresholds concerning management of forest carbon or greenhouse gas emissions. The 2012 Planning Rule and regulations require an assessment of baseline carbon stocks and a consideration of this information in management of the national forests (FSH 1909.12.4). Forests play an active role in controlling the concentration of carbon dioxide in the atmosphere. Forests store large amounts of carbon in their live and dead wood and soil, and are an important carbon sink, removing more carbon from the atmosphere than they are emitting (Pan 2011).

Key Indicators

- Carbon pools (carbon stocks) – sequestration and storage
- Natural/human-caused changes to landscape that influence carbon storage and sequestration (for example, vegetation succession, vegetation treatments, fire, insect outbreaks, disease) – influence to carbon pools

Methodology, Analysis Process and Information Sources

Existing regional-scale climate projections are used to understand the type and magnitude of climate change effects that could occur. The most recent National Greenhouse Gas Inventory (EPA 2015) provided information at the national level on forest contributions and conditions related to carbon sequestration. The update to the Forest Service 2010 Resources Planning Act Assessment (U.S. Department of Agriculture 2016) provided information on recent findings related to forest carbon conditions on all forest lands in the United States, as well as projected future carbon stocks and flows.

There are three models that are used to assess forest ecosystem carbon. These are the Carbon Calculation Tool (CCT), the Forest Carbon Management Framework (ForCaMF) (Healey 2010, Healey et al. 2014) and the Integrated Terrestrial Ecosystem Carbon (InTEC) model (Chen et al. 2000, Zhang et al. 2012).

The CCT uses Forest Inventory and Analysis program data, estimating baseline carbon stocks and carbon stock change from 1990 to 2013, based on data from two or more years of inventories conducted since 1990 (Woodall et al. 2013). Carbon stocks are estimated by linear interpolation between survey years. Recent estimates of baseline carbon stocks and trends for forests and harvested wood products have been provided for forestlands on national forest land in the United States (Heath et al. 2011, USDA 2015b).

Forest Carbon Management Framework (ForCaMF) uses Forest Inventory and Analysis program data in addition to remote sensing data (Landsat) to identify disturbances and estimates how much more carbon would be stored in the forest if those disturbances had not occurred. Integrated Terrestrial Ecosystem Carbon (InTEC) uses Forest Inventory and Analysis program data, Landsat disturbance data, plus environmental data (climate, atmospheric concentrations) to determine if a forest is accumulating carbon (a sink) or losing carbon (a source). InTEC and Carbon Calculation Tool (CCT) produce very similar results (for example, sink vs. source), but use different datasets and modeling approaches, so results may vary. Forest carbon disturbance assessments expand upon the earlier assessment of baseline carbon stocks across national forests by assessing how stocks are affected by timber harvesting, natural disturbances, land-use change, climate variability, increasing atmospheric carbon dioxide concentration, and nitrogen deposition (USDA, in review). The assessment integrates ForCaMF and InTEC models to calculate the relative impacts of disturbance (such as, fires, harvests, insect outbreaks, disease) and non-disturbance factors (climate, nitrogen deposition, carbon dioxide concentrations) on carbon stocks. The assessment assists in the evaluation of effects of broad forest management strategies and potential disturbance factors on carbon flux on the Custer Gallatin National Forest.

These data sources and assessments contain detailed discussions on models, analysis tools, and methodology used to provide the estimates of carbon stocks, as well as the limitations and uncertainties associated with the estimates.

Analysis Area

The importance of carbon storage capacity of the world's forests is tied to their role in removal and storage of carbon from the atmosphere at the global scale. The influence and contribution of the Custer Gallatin to carbon flux at the global scale is minimal and a meaningful analysis at the global scale is not practicable. However, global research has indicated the world's climate is warming and that most of the observed 20th century increase in global average temperatures is very likely due to increased human-caused greenhouse gas emissions. In response, the Custer Gallatin has identified carbon sequestration (storage) and associated climate regulation as a key ecosystem service. Potential effects of the proposed action and alternatives are described at the scale of the Custer Gallatin National Forest. National and regional factors related to forest's influence on carbon sequestration are also included to provide context for understanding the nature of the local forest effects.

The temporal scale for analyzing carbon stocks and emissions is the life of the plan with some analysis occurring across the longer term (50 years), consistent with the analysis period for other key ecosystem characteristics associated with the terrestrial vegetation.

Estimates of future carbon stocks (such as, stored carbon) and their trajectory over time will remain uncertain due to the uncertainty associated with the multiple interacting factors that influence carbon stocks and fluxes. This includes climate change and its effects on disturbance regimes and vegetation. While advances have been made in accounting and documenting the relationship between greenhouse gases and global climate change, difficulties remain in reliably simulating and attributing observed temperature changes to natural or human causes at smaller than continental scales (IPCC, 2007b, p. 72).

3.8.2 Affected Environment (Existing Condition)

Introduction

Forests and grasslands are constantly emitting carbon into the atmosphere and removing it, for example, storing it as biomass (sequestration). Carbon sequestration is the process by which atmospheric carbon dioxide is taken up by vegetation through photosynthesis and stored as carbon in forest biomass (plant stems, branches, foliage, and roots) and forest soils. Forests also release carbon, primarily though respiration and combustion. Forests and other ecosystems generally act as carbon sinks because growing plants remove more carbon dioxide from the atmosphere than they release during respiration. However, forests may become sources of carbon dioxide during and after disturbances such as wildfire and timber harvesting. This is usually a temporary effect before the disturbed forests begin to re-grow and resume their function as carbon sinks. Sequestering, or storing, carbon in forest ecosystems can help to offset sources of carbon dioxide to the atmosphere, such as from fossil fuel combustion, deforestation, and agriculture.

Interest in carbon sequestration is increasing and related to efforts to find ways to mitigate climate change worldwide by reducing atmospheric levels of greenhouse gases (which include carbon dioxide). The top three human-caused (anthropogenic) contributors to greenhouse gas emissions (from 1970-2004) are: fossil fuel combustion, deforestation, and agriculture (IPCC 2007, p. 36). Land use change, primarily the conversion of forests to other land uses (deforestation) is the second leading source of human-caused greenhouse gas emissions globally (Denman et al. 2007p. 512). Loss of tropical forests of South America, Africa, and Southeast Asia is the largest source of land-use change emissions (Houghton 2005, Denman et al. 2007 p. 518). Deforestation is not likely on national forest lands, because reforestation of harvested areas would occur, as required under the National Forest Management Act (1976).

Carbon Stocks and Trends

National Level

The Custer Gallatin National Forest is about 3.04 million acres or 1.6 percent of the 190 million acres of National Forest System lands in the United States. The National Forest System constitutes one-fifth (22 percent) of the Nation’s total forest land area and contains one-fourth (24 percent) of the total carbon stored in all United States forests, excluding interior Alaska (USDA 2015b). The National Forest System forest carbon resource has been growing since 1990, according to forest inventory and analysis data (FIA).

United States forests are a strong net carbon sink, absorbing more carbon than they emit (Houghton 2003, Heath et al. 2011, EPA 2015). In the most recent National Greenhouse Gas Inventory (EPA, 2015), current annual forest (public and private ownership) carbon sequestration (including harvested wood products) was reported at 211.5 teragrams (Tg) of carbon, offsetting approximately 11.6 percent of United States greenhouse gas emissions in 2013. The update to the Forest Service 2010 Resources Planning Act Assessment (U.S. Department of Agriculture 2016) provides a summary of recent findings related to forest carbon conditions on all forest lands in the United States from 1990 to 2015 as well as projected future carbon stocks and flows. Highlights from this summary are discussed below.

At the national level, forest carbon increased from 86,064 teragrams of carbon in 1990 to 91,262 teragrams of carbon in 2015. The rate of change between 2010 and 2015 was an estimated 222 teragrams of carbon per year, reflecting both the annual accumulation of new forested area (about 1.03 million acres per year) and growth of existing forests. Growth of existing forests accounted for the majority of this increase with a net sequestration of 132 teragrams of carbon per year during this period. The Eastern Region has the largest share of forests (444 million acres) and the highest forest carbon stocks (66 percent of the total) compared to the western United States (239 million acres of forests). The Rocky Mountain region (wherein the Custer Gallatin is located) was the only region where net sequestration of forestlands declined between 1990 and 2015. This likely reflects the effects of lower growth rates in aging forests (the dominant age class is over 100 years on both public and private lands) and the disturbances, particularly wildfire, during that time period.

Future projections of carbon inventory from forestlands from the updated assessment suggests that net carbon sequestration in the United States will continue to increase at similar rates as in the past up until about 2025, when it will begin to gradually decline, mainly due to transfers of private forestlands to other land uses due to changing socioeconomic environments. Within the United States, land use conversion from forest to other uses (primarily for development or agriculture) are identified as the primary human activities exerting negative pressure on the carbon sink that currently exists in this country's forests (Ryan et al. 2010b;a, McKinley et al. 2011). However, national forest lands are not subject to conversion to other land uses, such as agriculture or development. Thus, carbon storage changes from land use conversions is not a major factor for the forestlands within national forests, including the Custer Gallatin National Forest.

Regional Level

Total Ecosystem Carbon Flux

The Northern Region of the Forest Service covers an area stretching from northern Idaho (plus a small portion of eastern Washington) across to northwestern South Dakota. A nationally consistent carbon assessment framework has been developed for national forest system lands in every region and individual national forest to deliver information on carbon stocks and on forest carbon as influenced by disturbances (Office of Sustainability and Climate Change 2017). The forest carbon assessment framework consists of the varying modeling approaches and input datasets. Each of these models and data sources of have strengths on their own, but by integrating them a more comprehensive assessment of carbon dynamics is achieved. While these models complement one another, they utilize different data sources and modeling approaches and results may differ. Information and assessments are located at https://www.fs.fed.us/climatechange/advisor/products.html. Methodology, limitations and uncertainties associated with the carbon calculations and analysis are described within the assessments. This section of the EIS summarizes key information within the assessments for the Northern Region of the Forest Service and relevant to the analysis of carbon sequestration for the Custer Gallatin National Forest.

Baseline carbon pool estimates are calculated for national forest lands across the Northern Region and for each individual forest from 1990 to 2013; this included seven different forest ecosystem carbon pools – above-ground live tree, below-ground live tree, standing dead, understory plants, down dead wood, forest floor, and soil organic carbon (USDA 2015a). The Carbon Calculation Tool (CCT), which summarizes the available forest inventory and analysis data, uses measurements of tree volume from the available data and allometric equations (Biomass estimation equations) to estimate baseline carbon stocks and stock changes from 1990-2013 (Woodall et al. 2013). Figure 17 displays these carbon pool estimates for 1990 and 2013. The above-ground live biomass and soil organics constitute the largest proportion of the total forest ecosystem carbon. Above-ground live biomass is usually the most rapidly changing pool, and is more easily and directly estimated quantitatively from forest inventory and analysis data than other pools. Other pools are less easily detected and estimated, and/or subject to high spatial variability that is hard to quantify. Estimates of carbon stored in harvested wood products have also been calculated in regional assessments.

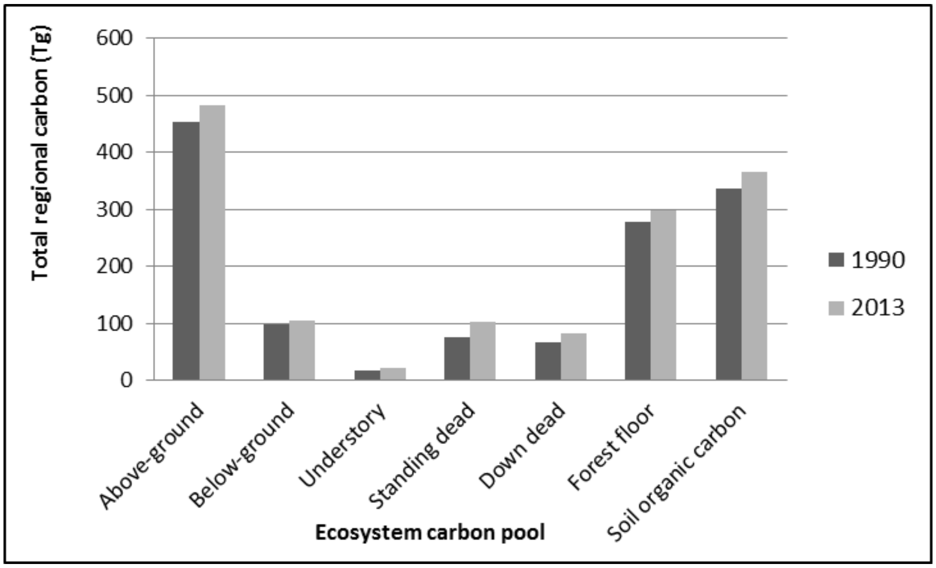

Figure 17. Carbon stocks in the seven forest ecosystem pools in national forest lands of the Northern Region for the years 1990 and 2013 (USDA 2015a)

According to the forest inventory data as summarized by the Carbon Calculation Tool (CCT) model, total forest ecosystem carbon (in all seven pools) stored in the Northern Region has steadily increased between 1990 and 2013, beginning with 1,324 teragrams in 1990 and reaching 1,458 teragrams in 2013. The Custer Gallatin, along with seven other National Forest in the region increased in forest carbon stocks. Forest carbon density (carbon stocks per unit area) increased slightly in the Northern Region from 1990 to 2013, from 64 teragrams per acre in 1990 to 65 teragrams per acre in 2013. Factors such as disturbances (for example, fire) and site quality may be responsible for these observed trends. However, changes in the forest inventory sampling design, protocols, and methodologies including the definitions of what constitutes forest land, also influenced these trends (Woodall et al. 2013). Total forest carbon (forest ecosystem and harvested wood products) stock change is estimated at 5.83 teragrams carbon per year for the Northern Region for the baseline period 1990 to 2013. This value represents the net sequestration rate of carbon by national forests in this region (USDA, 2015a). Carbon stock change is the change in carbon stocks over time, calculated by taking the difference between successive inventories and dividing by the number of years between these inventories for each national forest (Woodall et al. 2013). Stock change for a given year is the change between that year and the following year, for example the stock change for 2012 is the change between 2012 and 2013.

Harvested Wood Products

Carbon stored in harvested wood products contributes to the total forest carbon storage associated with national forests in the Northern Region. Harvest treatments that generate long-lived wood products, such as lumber and furniture, transfer ecosystem carbon to the harvested wood products carbon pool where carbon remains stored and doesn’t contribute to net greenhouse gas emissions. Some of the fastest growing carbon pools in the United States are landfills, where paper and construction waste break down very slowly (Skog 2008). Building materials such as concrete, steel, or plastic result in high greenhouse emissions, whereas wood products have a distinct carbon emission benefit. Forest vegetation treatments also generate excess material (woody biomass) which, if utilized, can be a renewable energy substitute for fossil fuels. One study indicated that allowing a harvested stand to grow and sequester carbon resulted in less emission of carbon dioxide than did that from harvest of that stand

and storage in wood products. However, when the effect of substituting wood for concrete and steel was also accounted for, then harvest scenarios resulted in less carbon dioxide emission than from the no-harvest scenario (Perez-Garcia et al. 2006).

The variation over time in carbon stored in harvested wood products is influenced primarily by changes in timber harvest levels. The cumulative carbon stored in the Northern Region harvested wood products began to accelerate substantially around 1955 and continued to increase at a steady rate until peaking in 1995 (Figure 18). Carbon in harvested wood products are displayed on the graph in both products that are still in use and carbon stored at solid waste disposal sites, including landfills and dumps. Since 2000, carbon stocks in the harvested wood product pool for the Northern Region have been in a slow decline as a consequence of harvest reductions from National Forests. The Northern Region harvested wood products pool is now in a period of negative net annual stock because the decay of products harvested between 1906 and 2012 exceeds additions of carbon to the harvested wood products pool through harvest.

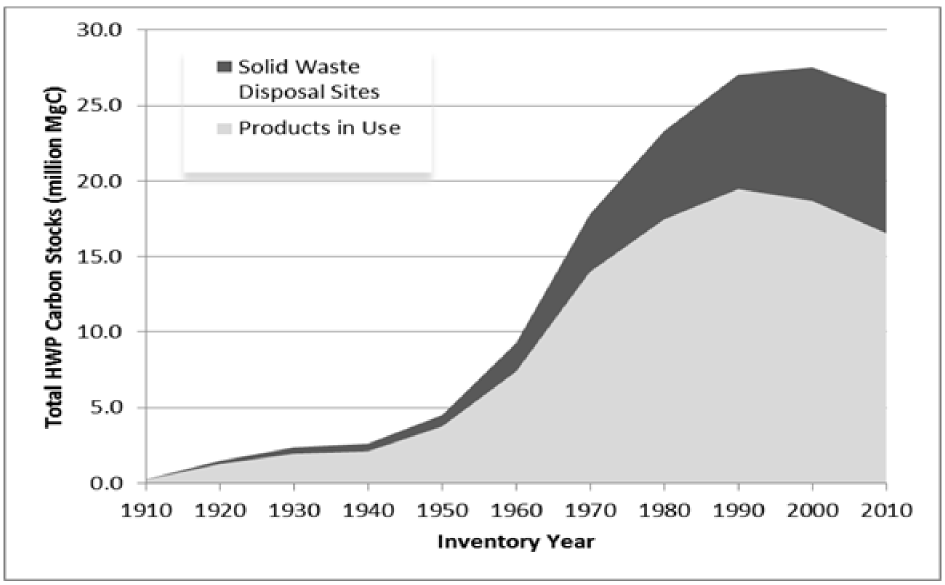

Figure 18. Cumulative total carbon stored in harvested wood products (HWP: products still in use and products at solid waste disposal sites) manufactured from Northern Region timber (Stockman et al. 2014)

Custer Gallatin National Forest Level

Total Ecosystem Carbon Flux

Carbon flux is the change in carbon stocks over time, calculated by taking the difference between the inventories and dividing by the number of years between the inventories (Woodall et al. 2013). Figure 19 shows carbon stock change for the Custer National Forest and the Gallatin National Forests between 1990 and 2013. A negative change means carbon is being removed from the atmosphere and sequestered by the forests (carbon sink), while a positive change means carbon is added to the atmosphere by forest-related emissions (carbon source) (USDA 2015). Both the Custer and the Gallatin national forests have likely been serving as carbon sinks from 1990-2013.

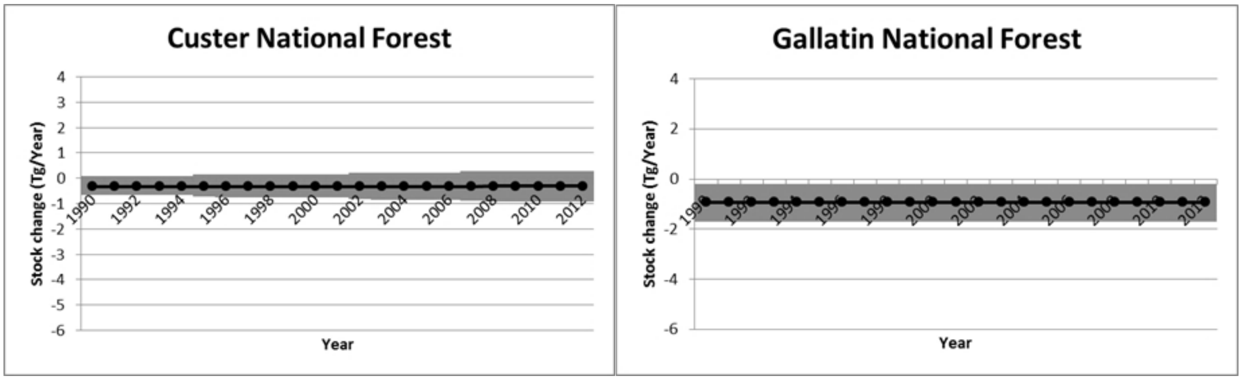

Figure 19. Carbon stock change on the Custer Gallatin for 1990 through 2013, bounded by uncertainty values (95% confidence level) (USDA 2015)

Although less well studied, some evidence show that grassland productivity and carbon pools may be decreasing, at least in the montane portions of the Custer Gallatin. For example, Brookshire and Weaver, (Brookshire and Weaver 2015) demonstrate a sustained decline over the last four decades in productivity and above-ground carbon pools in a native subalpine *F. idahoensis* ecosystem in the Bangtail Mountains northeast of Bozeman, Montana. They determined increasing aridity to be the primary cause and that changes in nitrogen deposition and atmospheric carbon dioxide contributed little to the long-term pattern.

Harvested Wood Products

Carbon has been removed from the forest through harvest of trees over the past 100 or more years. Some of this carbon is stored in wood products or in landfills and contributes to the total forest carbon storage on the Custer Gallatin. Carbon stored in harvested wood products has been estimated for the Custer Gallatin spanning a 100-year period from 1910 to 2010 (Anderson et al. 2013).

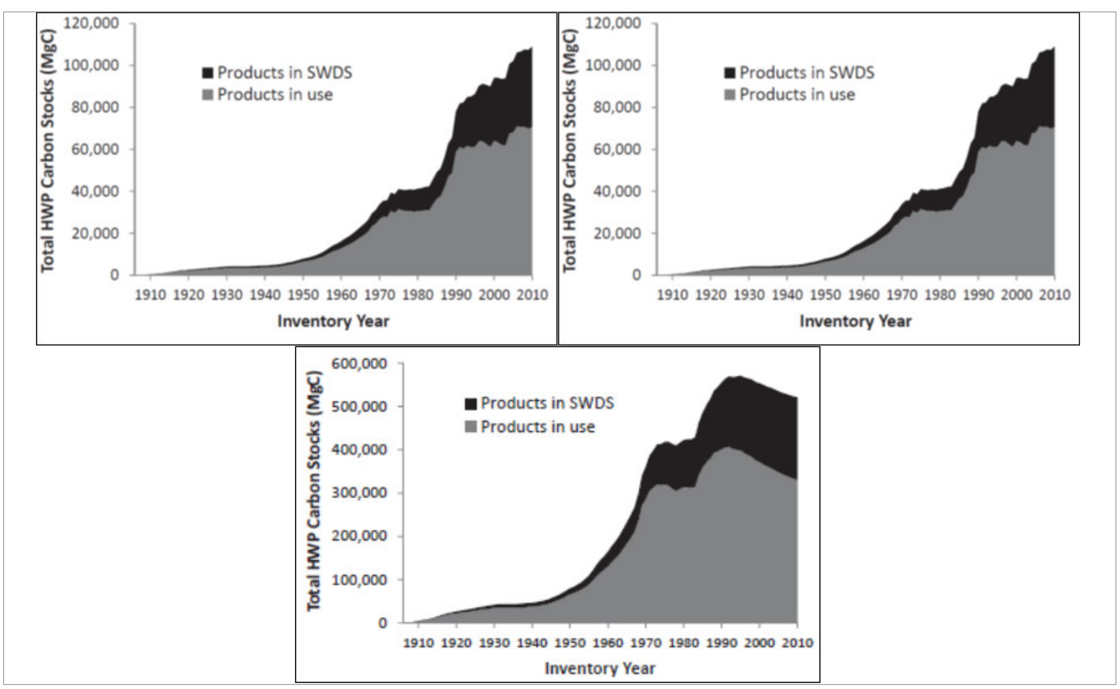

Figure 20. Cumulative total carbon stored in harvested wood products manufactured from Custer and Gallatin National Forest timber from the period 1910 through 2010 (N. Anderson et al. 2013)

The harvested wood products carbon pool includes both products in use and products that have been discarded to solid waste disposal sites (SWDS). Additions to the harvested wood products pool are made through harvesting, while emissions are from decay and combustion of wood products.

Influences on Carbon Stocks

Forests are highly dynamic systems that are continuously repeating the natural progression of establishment, growth, death, decay and recovery, while cycling carbon throughout the ecosystem and the atmosphere. Natural and human-related disturbances, such as wildfires, insect and disease activity, timber harvesting, and weather events, can cause both immediate and gradual changes in forest structure, which in turn affect forest carbon dynamics by transferring carbon between the different ecosystem and atmospheric carbon pools. An understanding of how disturbances and environmental factors affect carbon flux is necessary to assess potential future changes in carbon stocks and how forest management may influence them. The impacts on carbon pools from disturbance, management activities and environmental factors are analyzed in a regional disturbance assessment (U.S. Department of Agriculture 2017). Pertinent findings in that assessment are summarized in this section.

Regional Level

Figure 21 displays the percent of forest area in the Northern Region affected over time by main disturbance factors as derived from the remotely-sensed (Landsat) disturbance maps along with various ancillary data sources, including Monitoring Trends in Burn Severity (Eidenshink et al. 2007), Aerial Detection Surveys (Johnson and Wittwer 2008), and agency harvest records to attribute the disturbance types. The years from 2000 to 2011 show elevated levels of fire and insect disturbance compared to the 1990s, with the year 2007 experiencing the highest impact, in total affecting over 1.5 percent of the total forested area in the region. Harvest affected less than one quarter of a percent throughout the monitoring period.

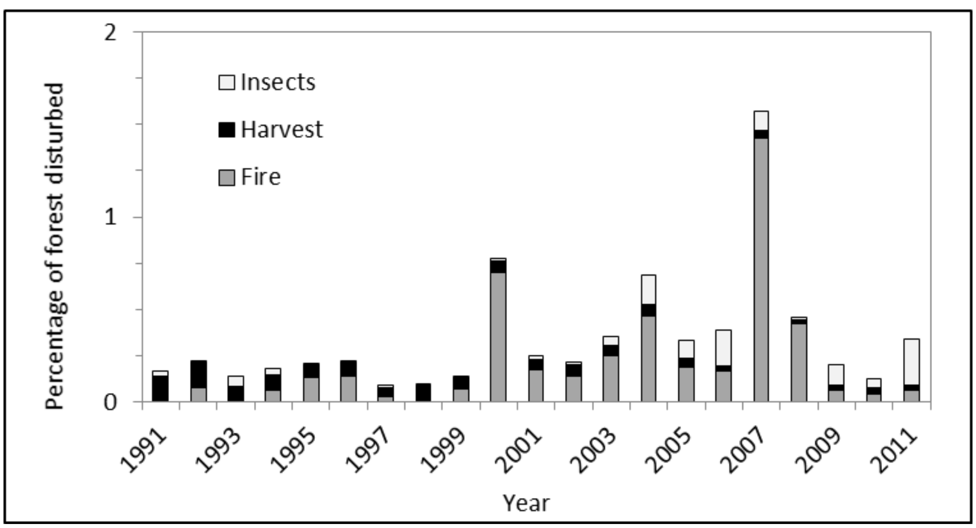

Figure 21. Northern Region rates of disturbance mapped using visual interpretation of several independent datasets and summarized as the percentage of forested areas disturbed by insects, fire, and harvest from 1991 to 2011 (USDA 2016)

Figure 22 displays the proportional importance and effects to carbon of each type of disturbance occurring in the region as accumulated from 1990 to 2011 and measured in 2011, according to results of the Forest Carbon Management Framework model. Root disease is included in this figure, as estimated from the forest inventory and analysis data, root disease severity variable (Healey et al. 2016). Fire and disease are clearly the dominant processes. The importance of insect activity, while currently relatively small, was not detectable through the 1990s.

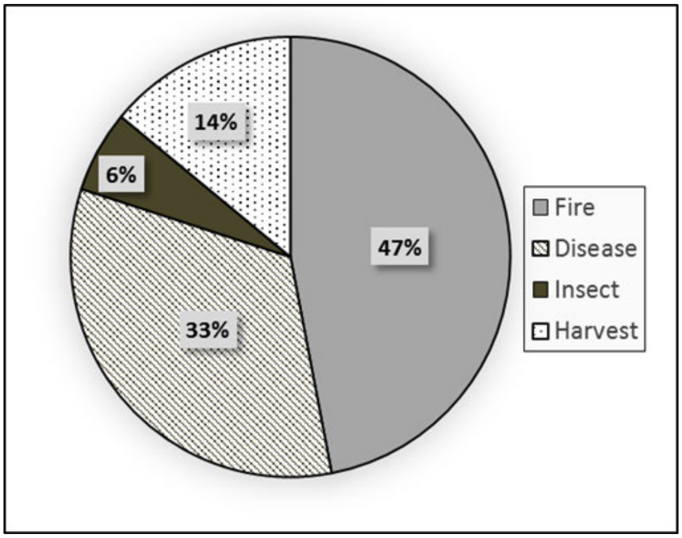

Figure 22. The effect of fire, insect, disease and harvest on carbon storage on national forest lands of the Northern Region for the period 1990 to 2011 (USDA, 2016)

Environmental factors, including climate, atmospheric concentrations of carbon dioxide, and nitrogen deposition influence rates of growth and productivity, and therefore, forest carbon stocks. Tree growth and age influence the rate of carbon sequestration and density. Growth adds live tree biomass, which results in carbon accumulation. Stand-level growth is typically most rapid, and thus accumulates the most carbon, when the stand is young through middle age, when productivity generally peaks (Zhang et al. 2012). Productivity gradually declines as the stands age and densities increase.

Figure 23 shows that in 2010 the majority of the forests in the Northern Region were greater than 80 years old with a distinctive pulse which established 80-110 years ago (from 1900 to 1930), according to Forest Inventory and Analysis data (U.S. Department of Agriculture 2017). The early 1900s pulse in stand establishment may be a result of regeneration after the last major fires before fire suppression, or after timber harvests, which intensified in the early 1900s. Fire suppression, which began in the early 1900s, allowed more of these young stands to grow undisturbed rather than being burned at typical historical rate (Pyne 1982). Depending on the forest dominance type, which is mostly Douglas-fir and subalpine fir, this pulse of establishment would have reached maximum productivity between 30-60 years of age (figure 24) or throughout the mid-to-late 20th century. Forests in the Northern Region show another pulse of young stands (less than 20 years old) which established between 1990 and 2010, as areas subject to recent large and often severe disturbances re-grow.

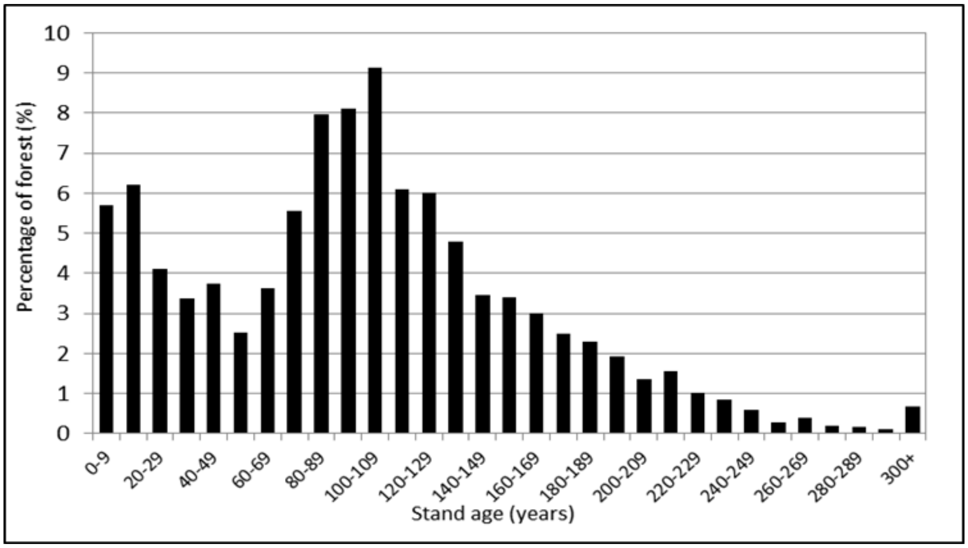

Figure 23. Percentage of forest land in 10-year age classes across all national forests in the Northern Region 2010 (USDA 2017)

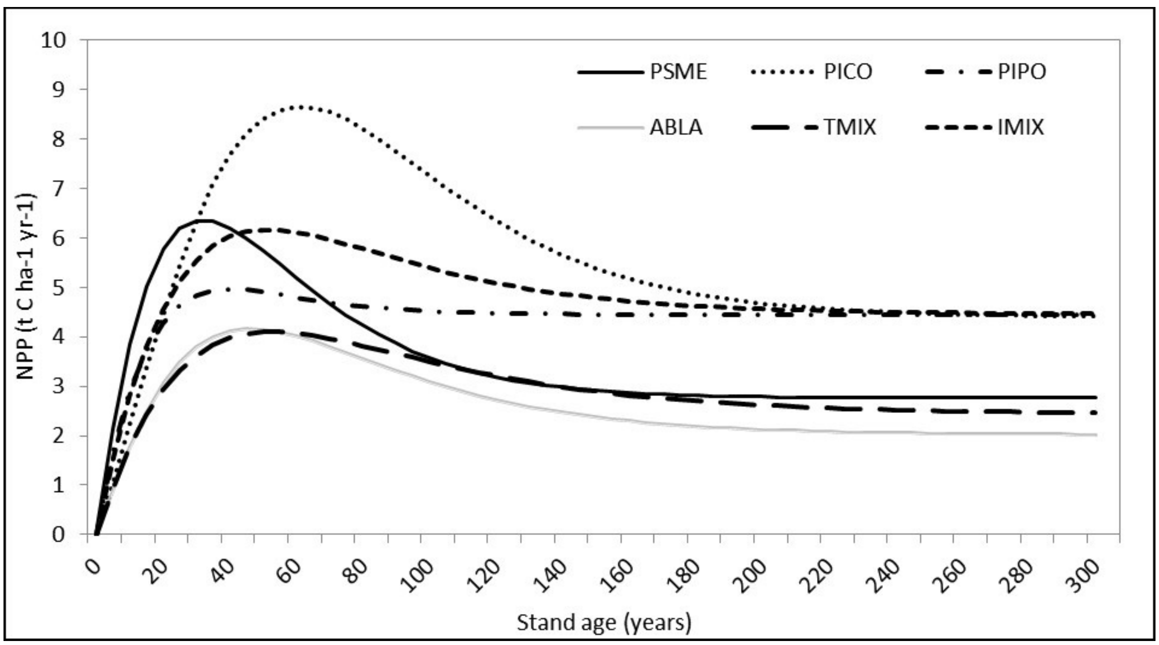

Figure 24. Relationship between net primary productivity and stand age for forest dominance types1 averaged across all national forests in the Northern Region (USDA 2017). Dominance types: Douglas fir (PSME), subalpine fir (ABLA), Lodgepole pine (PICO), Ponderosa pine (PIPO), shade-tolerant mixed conifer (TMIX), and shade-intolerant mixed conifer (IMIX)

The carbon stock changes across the national forests in the Northern Region show that forests have generally experienced a switch from a carbon sink to a carbon source and a decline in accumulated carbon according to results from the process-based Integrated Terrestrial Ecosystem Carbon model (figure 25; USDA 2017). Climate variability and the recent warming trend has had a mostly negative effect on carbon stocks, also contributing to the switch to a carbon source and loss of carbon (figure 26). Future warming may result in an intensification of these already negative climatic effects. The increases in nitrogen deposition and atmospheric carbon dioxide concentrations have both had positive effects on changing carbon stocks and carbon accumulation across all forests in this region (figure 26). However, the gains from carbon dioxide fertilization and nitrogen deposition were generally overshadowed by carbon losses due to negative disturbance/aging effects and climate effects (figure 26). Atmospheric carbon dioxide concentrations are expected to continue increasing for the foreseeable future, potentially counteracting the projected negative effects of climate.

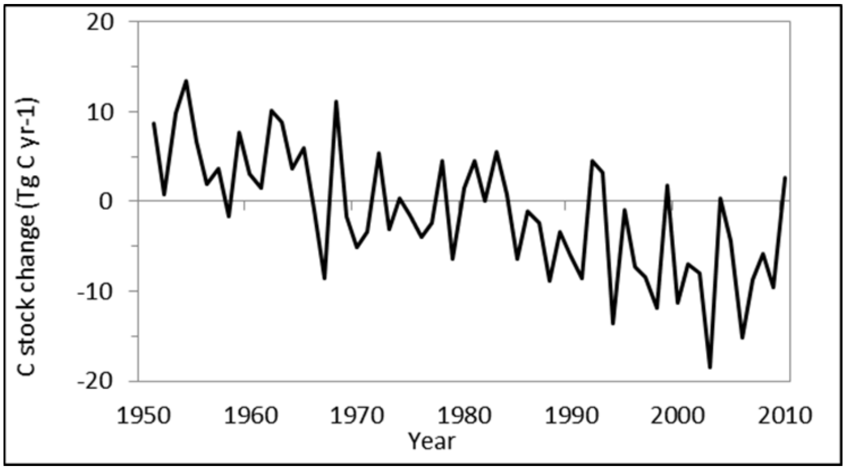

Figure 25. Estimated forest carbon changes and accumulations with all carbon change factors combined, summed across the national forests of the Northern Region (USDA 2017)

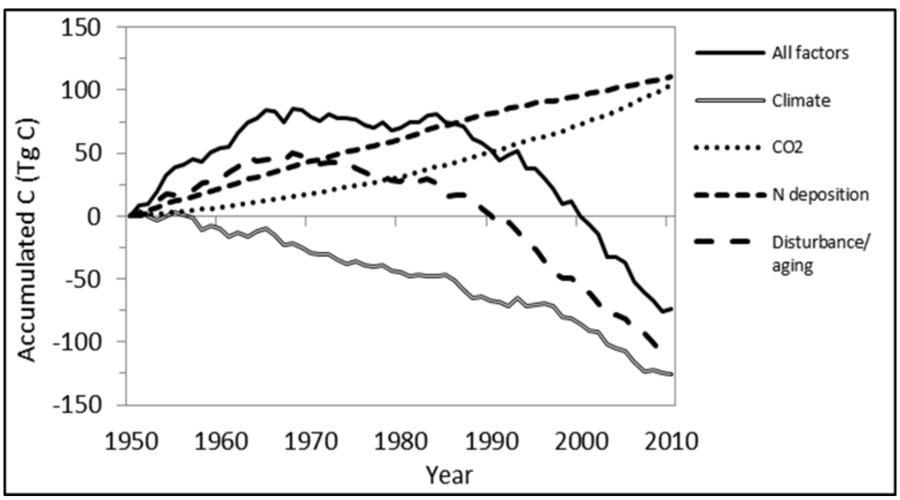

Figure 26. Estimated forest carbon changes and accumulations for disturbance/aging and non-disturbance factors, across the national forests of the Northern Region (USDA, 2017)

The assessment on effects on carbon from disturbances is not an exhaustive analysis for a number of reasons, as outlined in the disturbance assessment (USDA, 2017). Some disturbances that may have substantial impact are not covered due to lack usable data, such as root disease for some parts of the region. The assessment did not consider storage of carbon in harvested wood products, which defers emissions of the associated carbon until they decay or are disposed by burning. Furthermore, the results of the disturbance assessment may differ from the baseline forest carbon assessment (which relied only on Forest Inventory and Analysis data), which may be missing some of the recent or smaller disturbances. Integrating high-resolution, remotely sensed Landsat disturbance maps reveals slightly different trends.

An area of vulnerability to forest resilience and associated carbon sequestration and storage values is the increased risk of uncharacteristic fire, insect, and disease activity that might occur with climate change. Once a tree dies or loses a leaf or other plant part containing carbon, it will decompose and its sequestered carbon is either respired into the atmosphere or transformed into soil carbon. Large, high severity fires or large-scale insect outbreaks can affect regional carbon stocks and flux within forest ecosystems. In the short term (decades), disturbances with high tree mortality can convert carbon sinks to a carbon source (Kurz et al. 2008a, Kurz et al. 2008b, Kurz et al. 2008c). Over the long term (centuries), the effects of disturbances on the regional carbon balance are neutral, assuming similar vegetation regrows on the disturbed area and the long-term frequency and severity of disturbances does not change (Kashian et al. 2006, Canadell et al. 2007). It is possible that over the very long term, climate changes may alter site conditions and disturbance patterns on the Custer Gallatin National Forest to a degree that substantially impacts forest regrowth or vegetation types. This may reduce the national forest's capacity for carbon sequestration. This effect would be small in relation to global capacity to sequester carbon (Halofsky et al. 2018a). The net effects on forest health and carbon sequestration have a high degree of uncertainty, primarily because of uncertainty in the magnitude of future climate change, and complex interactions of forest with disturbances, climate and ecological processes.

National Forest Level

The types and pattern of major disturbances affecting carbon stores over a 20-year period on the Custer Gallatin are displayed in figure 27. Disturbances follow a similar pattern and proportion as occurred region-wide, with significant fire impact in 2007. Insect activity comprised a smaller portion of the total percentage of disturbance than was observed regionally.

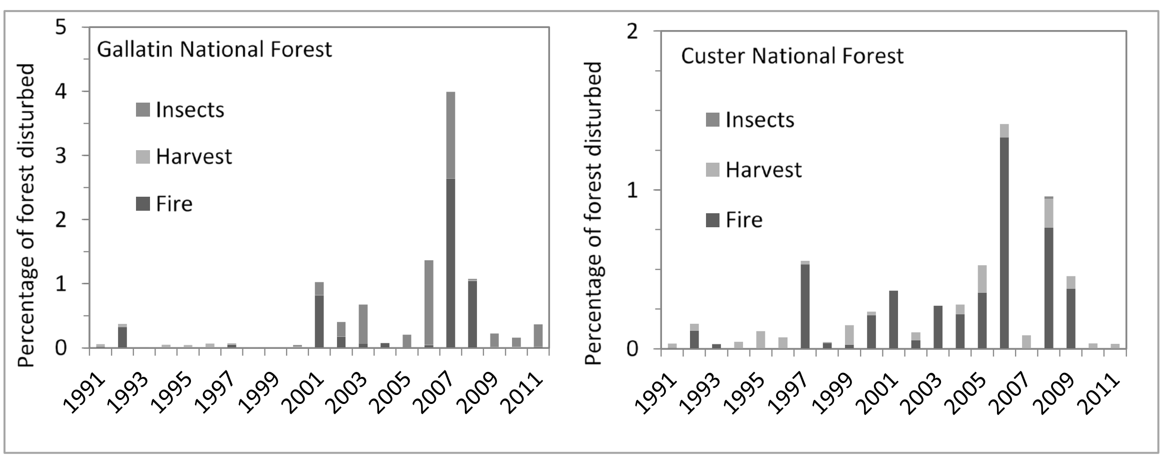

Figure 27. The percentage of forested areas disturbed from 1991 to 2011 by individual disturbance type in the Custer Gallatin national forest, using visual remotely sensed data (Landsat) and interpretation of several independent datasets (USDA 2017)

Figure 28 displays the estimated impact of the different disturbances (as assessed through Forest Carbon Management Framework) as expressed in relation to the amount of carbon that would have been stored in the absence of the particular disturbance. Specifically, the difference in storage for each year is shown between a "no-disturbance" scenario and a scenario that includes only observed amounts of the specified type of disturbance. Error bars represent 95 percent confidence intervals. One hundred grams per square meter equals one metric ton (or Megagram) per hectare (USDA 2017).

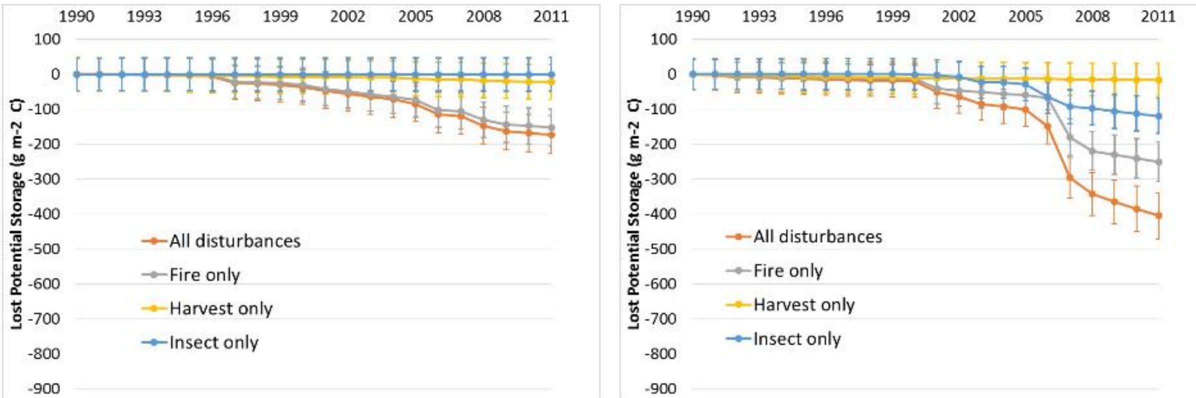

Figure 28. Lost potential storage of carbon as a result of fire, insect, harvest, and disease on the Custer Gallatin for the period 1990 to 2011, according to results from the Forest Carbon Management Framework model

The impact of a disturbance is felt beyond the year it happens. For example, a fire event will release carbon stored in forests in the year the event occurs. Even if the stands affected by fire are no longer carbon sources, their net carbon storage in the subsequent years is likely to be less than if the fire had not occurred, and the curve will continue to diverge from baseline for a time. Thus, figure 28 reflects the long-term impact of disturbance on the Custer Gallatin National Forest's ability to store carbon. The increased impact on carbon stocks from the effect of increased wildfire activity in the years since 2000 is reflected in the figure. The effects of these fires will likely continue through future decades both because carbon added through growth and recovery may not equal carbon that would have been added through continued growth, and because decaying material killed by the fire will mitigate carbon added through recovery.

Tree growth and associated forest ages influence the rate of carbon sequestration and carbon density on the Custer Gallatin. The Forestwide stand age distribution for the Custer and Gallatin National Forests is shown in figure 29.

From 1950-1993, forests in the Custer National Forest maintained a small carbon sink, but then switched to mostly a carbon source due to recent disturbances. Roughly 22 percent of the forests in the Custer National Forest are young (less than 10 year old), reflecting establishment and regrowth after significant fire and harvest disturbances in 2006, 2008, and 2009 (figure 28). As the predominantly young, ponderosa pine stands approach middle-age (about 35 years old) they will be growing at peak productivity suggesting carbon stocks may accumulate most rapidly in approximately two decades, and forests have the potential to switch to a carbon sink again. The negative influence of disturbances in the 2000s suggests the forests have not yet recovered carbon from these recent disturbances.

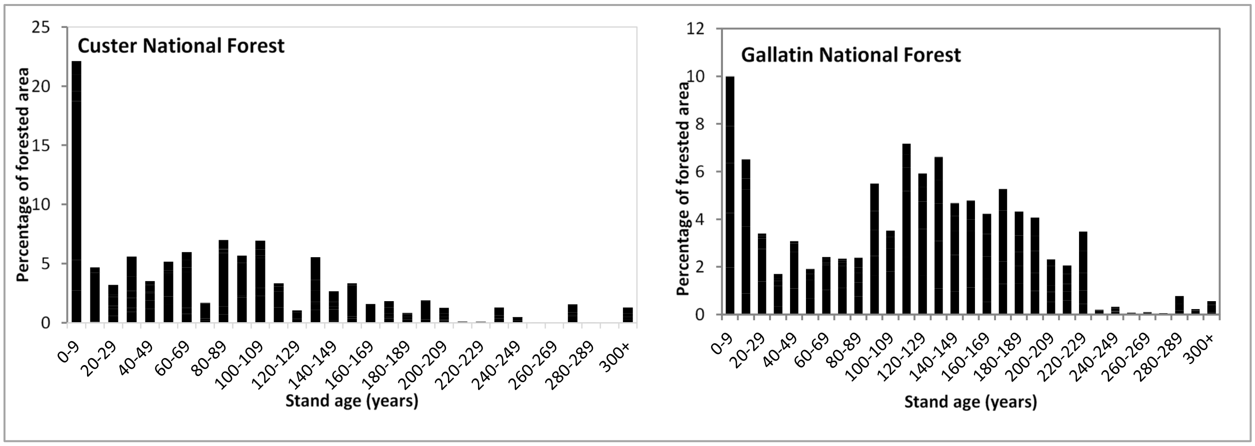

Figure 29. Age class distribution across the Custer Gallatin national forest in 2010 displaying the percentage of forested area in 10-year age classes (USDA, in review)

Between 1950 and 2010, forests in the Gallatin National Forest maintained a small carbon source, and experienced a downward trend in changing carbon stocks, mostly due to negative disturbance/aging effects. The stand age distribution indicates that approximately 66 percent of the stands are more than 90 years old, with a subtle pulse of stands establishing about 110-139 years ago (1871-1900) (figure 29); likely as a result of major fires or land-use change associated with Euro-American settlement in the region. Fire suppression activities beginning in the early 20th century enabled stands to survive and continue re-growing rather than being disturbed at a more typical historical rate. These middle-older aged stands have aged past their peak in net primary productivity and have been declining in productivity contributing to the decline in forest C from 1950-2010, as carbon losses from decomposition and decay were greater than carbon gains. About 17 percent of the stands consist of young forests, less than 20 years old (figure 29), indicative of establishment and recovery after recent, large disturbances, especially the fires and insect outbreaks in 2001 and 2006-2008. Although these recent disturbances caused an immediate loss of carbon through direct emissions to the atmosphere, this pulse of young stands indicates that forests are recovering and have the potential to become a carbon sink within a few decades, especially as they age to maximum productivity.

3.8.3 Environmental Consequences

Forests are biological systems that continually gain and lose carbon. Disturbances and forest management can affect net carbon stores by changing the amount of carbon stored in various pools and by altering the rate at which carbon accumulates in the ecosystem (net ecosystem productivity) (Fahey et al. 2009). Whether forests show a net gain (sink) or net loss (source) depends on the balance of these processes, and must be interpreted in light of the long development trajectories of forests in the northern Rocky Mountains. There is general understanding of forest conditions, carbon storage dynamics, and capacity, as well as estimates on how disturbances may impact carbon stores. However, carbon sequestration and emission dynamics from forested ecosystems can be complex and uncertain. This analysis focuses on expected trends of carbon stocks and the forest carbon flux, and the potential influence of various strategies and approaches to management of the Custer Gallatin National Forest.

All Alternatives

Management Direction under the Current Plans

The existing forest plans contain no plan components or direct acknowledgment related to carbon sequestration, or the use of management approaches to mitigate greenhouse gas emissions and climate change. Both existing plans contain direction aimed at promoting the sustainability of vegetation.

Management would continue similarly as in the recent past, resulting in a similar pattern of carbon storage and flux as discussed in the affected environment section. Direction in the current plans aimed at promoting the sustainability of vegetation could trend the Custer Gallatin towards greater resiliency, and thus enable the national forest to provide carbon sequestration over both the short and long term.

Management Direction under the Revised Plan Alternatives

The revised forest plan recognizes the important role of the forest related to carbon storage and sequestration, establishing a desired condition that directly addresses carbon sequestration. This desired condition applies to all revised plan alternatives and focuses on sustaining this key ecosystem service through maintenance or enhancement of ecosystem biodiversity and function and managing for resilient forests adapted to natural disturbance processes and changing climates.

Effects Common to all Alternatives

National and Regional Level

At the broad scale, wildfire and extensive forest mortality as a result of insect and disease are primary sources of unintentional carbon emissions from forests in western United States (Stephens and Moghaddas 2005). This can lead to widespread loss of centuries' worth of carbon storage. This effect will likely be exacerbated in coming decades under continued warming, with increasingly severe fire years (Westerling et al. 2006). Drought stress, forest fires, insect outbreaks, and other disturbances may reduce existing carbon stock (Galik and Jackson 2009, Hicke et al. 2012). Climate change threatens to amplify risks to carbon stocks by increasing the frequency, size, and severity of these disturbances, particularly in the northern Rocky Mountains (Dale et al. 2001, Running 2006, Westerling and Bryant 2008, Littell et al. 2009a, Boisvenue and Running 2010). Further, increases in the severity of disturbances, combined with projected climatic changes, may limit post-disturbance regeneration, and prevent forests from returning to a carbon source (Barton 2002, Savage and Mast 2005, Allen 2007, Strom and Fule 2007a, Kurz et al. 2008a, Kurz et al. 2008c, Galik and Jackson 2009).

Current literature suggests the long term ability of western United States' forests to persist as a net carbon sink is uncertain due to the uncertainty associated with the multiple interacting factors that influence carbon stocks and fluxes (Lenihan et al. 2008, Ryan et al. 2008b, Galik and Jackson 2009, Pan 2011). These factors include: climate variability and change, potential positive effects of increased atmospheric carbon dioxide concentrations on plant productivity, frequency, duration, and severity of moisture stress, changes in the rate and severity of natural disturbances, and land management practices (Canadell et al. 2007). Recent research indicates these risks may be acute for some forest types and in some areas of the country, including the Rocky Mountain forests (Boisvenue and Running 2010). Some of the more severe impacts occur in drier forest types, particularly those in transition areas where forest meets grassland vegetation types. Increases in the severity of disturbances, combined with projected climatic changes, may limit post-disturbance forest regeneration, shift forests to grass or shrub-lands, and possibly convert large areas from an existing carbon sink to a carbon source (Barton

2002, Savage and Mast 2005, Allen 2007, Strom and Fule 2007b, Kurz et al. 2008a, Kurz et al. 2008c, Galik and Jackson 2009).

Harvested wood is important when considering carbon benefits from forests. Treatments that generate long-lived wood products, such as lumber and furniture, transfer ecosystem carbon to the harvested wood product carbon pool. Carbon storage in long-lasting wood products, as well as in waste held in landfills, are important components of the carbon balance. Current additions of carbon to these carbon pools from trees harvested in the United States are greater than decomposition losses from these pools, so carbon stored in these pools is increasing (Ryan et al. 2010b).

Forest Level

A key principle in carbon management is to emphasize ecosystem function and resilience (McKinley et al. 2011; USDA, 2015b). Under the current plans, management would continue similarly as in the recent past; resulting in a similar pattern of carbon storage and flux as discussed in the affected environment section. Direction in the current plans aimed at promoting the sustainability of vegetation; it could trend the Custer Gallatin towards greater resiliency and thus enable the forest to provide carbon sequestration over both the short and long term.

As required by planning regulations (USDA 2015c), the strategy for vegetation management on the Custer Gallatin National Forest under the revised plan alternatives is to provide for ecological integrity and resilience, supporting a diversity of plant and animal communities, and to provide for social and economic contributions to local communities. In response to this direction, all revised plan alternatives incorporate an ecologically based approach to vegetation management, including direction to manage for conditions that would occur under a natural disturbance regime, and be more resilient in the face of future uncertainties. The revised forest plan also explicitly recognizes the importance of the role of the Custer Gallatin related to carbon storage and sequestration, establishing a desired condition that directly addresses carbon sequestration. This desired condition focuses on sustaining this key ecosystem service through maintenance or enhancement of ecosystem biodiversity and function, and managing for resilient forests adapted to natural disturbance processes and changing climates. This approach to management of forests for purposes of contributing to climate change mitigation is supported by a number of scientific sources (Ruddell et al. 2006, Hurteau et al. 2008, Reinhardt and Holsinger 2010, Ryan et al. 2010a, Wiedinmyer and Hurteau 2010, North and Hurteau 2011, Schaedel et al. 2017). The forest plan direction in the revised plan alternatives provide more clarity and stronger integration of ecological concepts and management for resilient forest conditions than current plans.

All alternatives include some level of forest management. Forests can be managed to sustain and perhaps increase their ability to remove carbon from the atmosphere. Carbon sequestration may be enhanced through management strategies that maintain resilient forests, able to adapt to a changing climate and other stressors, and reforest lands disturbed by wildfires and other natural events. In terms of carbon storage, forest regeneration after large wildfires will be critical (Zhao et al. 2018).

Management strategies applicable to the Custer Gallatin National Forest center on creating conditions resistant and resilient to disturbances that may be amplified by climate change. This is the same across all alternatives and is fundamental to maintain carbon storage and uptake in terrestrial ecosystems. Actions that have the potential to increase forest resilience to stressors are often suggested “adaptation actions” (Millar et al. 2007, Joyce 2008, Ryan et al. 2008a). Resilient forests are those that not only accommodate gradual changes related to climate, but tend to return toward a prior condition after disturbance either naturally or with management assistance (Millar et al. 2007). For the forests of the Custer Gallatin National Forest, this may include a variety of strategies, depending on site specific conditions, such as reducing stand density and increasing the abundance and distribution of large diameter trees of fire resistant species. Mitigation measures have been suggested as additional options to reduce greenhouse gas emissions (Millar et al. 2007). Options to increase carbon sequestration applicable to Custer Gallatin National Forest forests include: measures such as maintaining healthy, vigorous trees; manipulation of vegetation to favor rapid growth; keeping sites fully occupied with trees with minimal spatial or temporal gaps in non-forest conditions; promoting reforestation; minimizing severe disturbance by fire, insects and disease; and sequestering carbon after harvest in wood products (Harmon and Marks 2002, Kobziar et al. 2006, Krankina and Harmon 2006). Even though practices such as thinning and prescribed fire may release carbon in the short term, they focus growth and storage for the future on trees that are at lower risk and/or more resilient to disturbance. Appropriate forest management and protection can substitute lighter, strategically placed, and more recoverable emissions for disturbance emissions that would be more severe, extensive, and less reversible (USDA 2015a).

Under all alternatives, the expected levels of disturbances that may most substantially influence carbon storage (wildfire, harvest, bark beetles, and prescribed fire) would be similar. Figure 30 displays projected acres of the Custer Gallatin National Forest affected by these disturbances.

Figure 30 demonstrates that carbon flux across the Custer Gallatin National Forest over the life of the plan would be influenced primarily by natural disturbances more so than timber harvest. The majority of the Custer Gallatin occurs in largely unroaded areas not suitable for timber production. Timber harvest would occur across a limited area; where it does occur, if carbon stored in harvested wood products is factored in, this would offset some of the proportion of carbon lost to tree removal. Because there is relatively little variability across alternatives, the figure shows averages and standard deviations across all alternatives over a 5-decade period (source: PRISM model for harvest; SIMPPLLE model for wildfire and insect activity).

Considering these past and expected future conditions, disturbances and their influence on carbon dynamics, it could be expected that carbon storage and sequestration fluctuations over the next 20 to 50 years would be similar to that experienced in the recent past. Though disturbances would result in an immediate carbon loss, forest establishment and growth may recover that loss over several decades. Carbon storage is not necessarily at an equilibrium, but can increase and decrease over time (Smithwick et al. 2002, Luyssaert et al. 2008), with risk of large pulses of carbon loss due to disturbance in large areas of mature forest (Fahey et al. 2009).

If exceptionally high amount of fire occurs across successive decades, or if fires are more severe and larger than historically, forest conditions may be affected to the point where carbon balances would be substantially altered. For the relatively near future (for example, the next 20 to 50 years), it is expected that recovery of forest conditions would occur after most disturbances, though there may be species shifts, and recovery may be prolonged in some areas. In addition, there is the possibility that forest productivity and density may increase in some areas with warming climates, such as in higher elevation forests (Halofsky et al. 2018a, Hansen et al. 2018). This may offset some of the loss at a local scale.

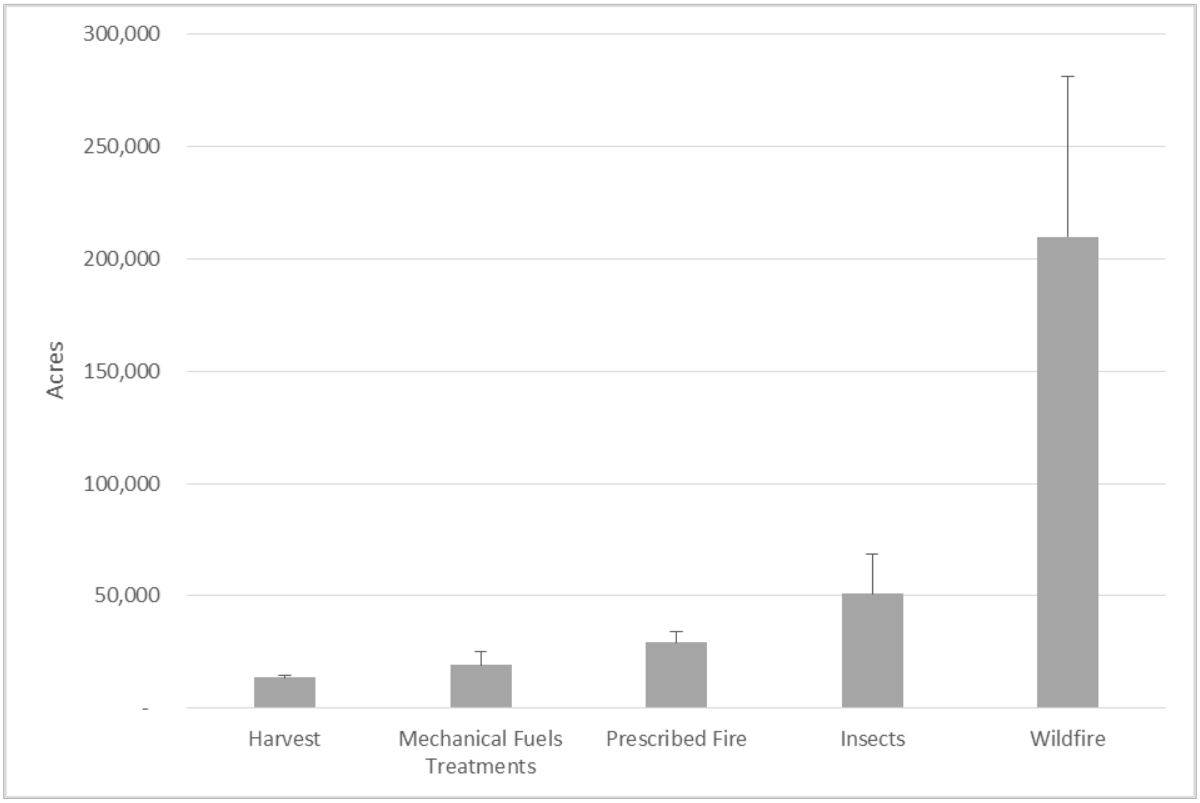

Figure 30. Projected area affected per decade by harvest, mechanical fuel treatments (noncommercial), prescribed fire, insects (primarily spruce budworm and bark beetles), and wildfire on the Custer Gallatin National Forest

The forest management strategies incorporated into the revised plan direction for all revised plan alternatives are centered on the goal of maintaining or increasing forest resilience and resistance. The desired conditions are designed to sustain and create forests with the composition and structure that are able to accommodate gradual changes related to climate and with the capacity to return toward a prior condition after disturbances. Increasing forest resistance and resilience to fire, drought, insects and disease slow the release of carbon and retain larger portions in forest carbon pools; this is important considering that natural disturbances of fire and insect/disease has accounted for most of the carbon stock loss over the past 20 years. All revised plan alternatives result in a similar and desirable trend towards improved resilience over the next five decades, and would have a potential beneficial effect on sustaining or improving the natural carbon sequestration potential of the national forest lands.

Examples of the management strategies incorporated into forest plan direction that would contribute to carbon sequestration potential include the following (Harmon and Marks 2002, Kobziar et al. 2006, Krankina and Harmon 2006, Millar et al. 2007):

- managing forests to favor rapid growth
- increasing abundance and distribution of large diameter trees of fire-resistant species
- lowering forest densities and forest fuel conditions
- rapid reforestation after disturbances
- maintaining healthy, vigorous trees

- keeping sites fully occupied with trees
- sequestering carbon after harvest in wood products
- providing wood and biomass for fuel

Some management treatments may reduce carbon at the stand level in the short term, but result in maintaining or improving carbon sequestration potential in the long term. Examples include pre-commercial thinning in young, sapling stands, prescribed fire, and other fuel treatments. Thinning in young forests is a beneficial treatment to achieve forest conditions that improve resistance and resilience (such as desired species, tree sizes and densities) and to achieve climate change mitigation though carbon sequestration. Though thinning reduces carbon stores in the short term, there may be no discernable difference in thinned vs unthinned stands in total above-ground carbon stores several decades after thinning, due to the larger trees and differences in understory and woody material (Schaedel et al. 2017). Similarly, there are short-term loss of carbon stores with prescribed burning or other fuel treatments, but studies suggest there may be long-term benefits in the event of a future wildfire, with lower fire severity in the treated stands resulting in less consumption of live and dead tree biomass, higher tree survival, lowered decompositions emissions, and shortened recovery times (Hurteau et al. 2008, Reinhardt and Holsinger 2010, Wiedinmyer and Hurteau 2010, North and Hurteau 2011). This fuel reduction effect is most pronounced in dry forest types that historically experienced low to moderate (mixed) severity fire.

Consequences to Carbon Storage and Sequestration from forest Plan Components associated with Other Resource Programs or Management Activities

Effects from Terrestrial Vegetation Management

Under all revised plan alternatives, plan components for terrestrial vegetation would make sure forested and non-forested plant communities are managed to be resilient, therefore ensuring that the carbon sequestration capacity is maintained over the long term on the Custer Gallatin National Forest. The current plans do not prescribe desired conditions based on the natural range of variation, but would also result in the lands of the Custer Gallatin National Forest being managed for native vegetation communities and therefore would provide a similar potential for carbon sequestration.

Effects from Fire and Fuels Management

Fire, (both natural and human ignitions) pose the greatest potential for short-term reductions in carbon sequestration by removing vegetation as well as causing carbon emissions. However, fire is also a primary mechanism for restoring and maintaining native vegetation with conditions consistent with the natural range of variation, thereby contributing to carbon sequestration potential over the long term. Plan components for fire and fuels management would help make sure the long term sustainability of vegetation communities while also allowing for flexibility in allowing fire to play its natural role on the landscape. These factors would generally be the same for all alternatives.

Effects from Timber Management

Plan components for timber management would allow for the short-term, localized reduction of carbon sequestration through the removal of living vegetation. The magnitude of this is greatest in alternative E and least in alternative D, but the difference between alternatives is minor. However, plan components that guide timber management, including desired vegetation conditions, would make sure that forest resiliency is promoted by these activities; therefore timber management would contribute to the long-term capacity of forests to sequester carbon.

Effects from Permitted Livestock Grazing

In all alternatives, livestock grazing would occur on the Custer Gallatin National Forest. Plan components would make sure that grazing is managed in a manner that would maintain desirable vegetation communities, and therefore would not preclude the carbon sequestration potential of rangelands under any alternative.

Effects from Watershed, Soil, Riparian, and Aquatic Management

Measures to protect aquatic habitat, riparian management zones, and watersheds would generally result in vegetation being maintained as needed for watershed function, and would result in a greater likelihood of vegetation cover being maintained within riparian management zones. These measures would be greater for the revised plan alternatives than the current plans. The retention of vegetation in riparian areas would provide areas of refugia (potential old growth), and seed sources to contribute to the larger resilience (and therefore carbon sequestration potential) of vegetation on the landscape over time.

Cumulative Effects

Within the United States, land use conversions from forest to other uses (primarily for land development or agriculture) are identified as the primary human activities exerting negative pressure on the carbon sink that currently exists in this country's forests (Conant et al. 2007, Ryan et al. 2010b, McKinley et al. 2011). The population is growing in some communities associated with the Custer Gallatin National Forest, primarily on the west side of the national forest, and conversion of forest lands to non-forest purposes may occur to some degree on private lands near the Custer Gallatin.

The impact of the alternatives and proposed forest plan direction on atmospheric concentrations of greenhouse gasses or global warming is not likely to be large at the global scale. This takes into consideration the global scale of the atmospheric greenhouse gas pool and the multitude of natural events and human activities contributing globally to that pool.

Federal, state, and privately owned forest lands in the vicinity of Custer Gallatin National Forest are generally managed to maintain ecological integrity and/or ensure sustainable timber yields; unlike other parts of the world, deforestation is not a primary concern for decreased carbon sequestration (Halofsky et al. 2018a). Sustainable management practices and promoting healthy, resilient forest ecosystems increase the ability of the Custer Gallatin to provide long-term carbon sequestering services (Halofsky et al. 2018a).

Conclusions

National forests are especially important for the persistent, long-term contribution to greenhouse gas mitigation they are capable of providing. This is because land use conversion from forests to other uses is a primary human activity affecting carbon stores both globally and nationally, and forests on National Forest System lands are not subject to conversion to other uses (except in extremely limited and local situations, such as road construction).

Although resilient vegetation conditions can be promoted under the existing forest plans, all of the revised plan alternatives contain plan components that more explicitly provide for the resiliency of ecosystems on the Custer Gallatin National Forest and acknowledge carbon storage as a function of these lands. The revised plan alternatives would better ensure that carbon sequestration is provided into the future, as appropriate for the natural vegetation types and disturbance processes that shape these ecosystems.

Natural ecosystem processes and disturbances will continue to be the primary influence on carbon storage, accumulation, and emission patterns, with harvest accounting for only a very small portion of the effect of carbon loss. Forest plan direction for vegetation management is designed to maintain and increase forest resistance and resilience to fire, drought, insects, and disease. All revised plan alternatives are expected to result in a similar and desirable trend towards improved forest resilience. This is beneficial because it will help sustain or improve the natural carbon sequestration potential of the national forest lands.

Uncertainties in amount of future disturbances exist, especially related to factors associated with climate change. If changes in natural fire regimes occur in the future, perhaps to a regime of more frequent, more severe, and/or more extensive areas burned over shorter time periods, then the relationship between carbon sequestered in live forest inventory and that within decaying dead trees after fire could shift. Because forest carbon loss contributes to increasing climate risk and climate change may impede regeneration following disturbance, avoiding deforestation, and promoting regeneration after disturbance should receive high priority (McKinley et al. 2011).

3.9 Invasive Species

3.9.1 Introduction

A species is considered to be invasive if it meets two criteria: (1) it is nonnative to the ecosystem under consideration, and (2) its introduction causes, or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112, 1999). Invasive species includes all taxa, including plants (such as state and county designated noxious weeds), vertebrates, invertebrates (such as emerald ash borer, non-native mussels), and pathogens (such as blister rust or white-nosed syndrome fungus).

Management activities for aquatic and terrestrial invasive species (including vertebrates, invertebrates, plants, and pathogens) are based upon an integrated pest management approach on all areas within the National Forest System, and on areas managed outside of the National Forest System under the authority of the Wyden Amendment (PL. 109-54, section 434), prioritizing prevention and early detection and rapid response actions as necessary (FSM 2900). Integrated pest management is an ecosystem-based strategy that focuses on long-term prevention of invasive species or their damage through a combination of techniques such as physical, biological or chemical control, habitat manipulation, modification of cultural practices, or ultra violet light (for white-nose syndrome pathogen control). While each situation is different, the following major components are common to all integrated pest management programs: prevention, early detection/rapid response, control and management, restoration, and collaboration (U.S. Department of Agriculture 2013).

Regulatory Framework

All Invasive Species

The Federal Insecticide Fungicide and Rodenticide Act (Public Law 92-516) requires all pesticides to be registered with the Environmental Protection Agency. It also states that it is unlawful to use any registered pesticide in a manner inconsistent with its labeling.

Executive Order 13112 directs Federal agencies to prevent the introduction of invasive species; detect and respond rapidly to and control populations of such species in a cost-effective and environmentally-sound manner; to monitor invasive species populations accurately and reliably; to provide for restoration of native species and habitat conditions in ecosystems that have been invaded; to conduct research on invasive species and develop technologies to prevent introduction; to provide for environmentally sound control of invasive species; and to promote public education on invasive species and the means to address them. Federal agencies are also called to collaborate with Federal, State, and local partners to address invasive species that can spread from adjacent lands. All of these actions are subject to the availability of appropriations. The desired condition inferred from Executive Order 13112, FSM 2900 and the national strategy is the prevention of new infestations (within the area where activities would occur or from the use of travel routes associated with those activities) and to manage the infestations currently established on the Custer Gallatin through control measures. For all forests, management goals for invaders are to:

- Potential invaders—prevent establishment, and if found, promptly eradicate
- New invaders—for small infestations, eradicate, and for larger infestations, reduce
- Widespread invaders—contain areas that are already infested and reduce populations.

U.S. Department of Agriculture 2013 provides broad and consistent strategic direction on the prevention, detection, and control of invasive species and incorporates the Invasive Species Systems Approach to respond to threats over the next 5 to 10 years. This framework directs the Forest Service to: 1) Determine the factors that favor establishment and spread of invasive plants; 2) Analyze invasive species risks in resource management projects; and 3) Design management practices that reduce these risks.

Noxious Weeds

The Federal Noxious Weed act of 1974 states that each Federal agency shall establish and adequately fund an undesirable plant management program; complete and implement cooperative agreements with state agencies regarding the management of undesirable plant species on Federal lands under the agency’s jurisdiction; and establish an integrated management system to control or contain undesirable plant species targeted under cooperative agreements.

The Carlson-Foley act of 1968 (Public Law 90-583) authorizes and directs heads of Federal Departments and Agencies to permit control of noxious plants by State and local governments on a reimbursement basis in connection with similar and acceptable weed control programs being carried out on adjacent non-federal land. In other words, this act permits county and state officials to manage noxious weeds with herbicides on Federal lands and to be reimbursed for that management, given that other applicable laws such as the National Environmental Policy act are also met.

The State of South Dakota Code. There is a regulatory designation of certain terrestrial and aquatic invasive plants which are identified as "noxious weeds" defined through individual State statutes. A noxious weed is defined by South Dakota Code (chapter 38-22, article 12:62:02:01) as "a weed which the commission has designated as sufficiently detrimental to the state to warrant enforcement of control measures."

The State of Montana Code. There is a regulatory designation of certain terrestrial and aquatic invasive plants which are identified as "noxious weeds" defined through individual State statutes. A noxious weed is defined by Montana Code Annotated (MCA 7-22-2101) as "any exotic plant species established or that may be introduced in the state that may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses or that may harm native plant communities".

The State of Montana County Noxious Weed Management act states that it is unlawful for any person to permit any noxious weed to propagate or go to seed on the person's land, except that any person who adheres to the noxious weed management program of the person's weed management district or who has entered into and is in compliance with a noxious weed management agreement is considered to be in compliance with this section.

South Dakota Portion of the Sioux Ranger District, Custer Gallatin National Forest Weed Seed Free Order 2007. National Forest lands in the South Dakota Portion of the Custer Gallatin National Forest, possessing or storing any hay, hay cubes, straw, grain, or other forage or mulch product, without original and current documentation from a state certification process which meets or exceeds the North American Weed Free Forage or comparable certification standard is prohibited. Tags, twine, or other certification marking is required on all individual bales, containers, sacks, etc., as required or provided for by the product's state of origin. Exempt from this order are: 1) Persons with a permit specifically exempting them from this order; 2) Any member of an organized rescue force in the performance of an official duty under emergency conditions; 3) Feed pellets one inch in diameter and smaller or steam-rolled feed grains; 4) Persons transporting forage products across National Forest System lands without unloading or using the products on National Forest System lands, roads, or trails.

National Forest System Lands in Montana Weed Seed Free Order 1997. For National Forest System lands in Montana the possession or storage of hay, grain, straw, cubes, pelletized feed or mulch that is not certified as being noxious weed free or noxious weed seed free by an authorized State Department of Agriculture official or designated county official is prohibited; each individual bale or container must be tagged or marked as weed free and reference the written certification. Exempt from this Montana National Forest System Special Order are: 1)Persons with a permit specifically authorizing the action or omission; and 2)Transporting feeds, straw, or hay on Federal, State, and county roads that are not Forest Development Roads or Trails.

Forest Service Manuals 2070, 2080, 2150 and 2900 provide additional invasive species management direction.

Custer National Forest Noxious Weed Management Environmental Impact Statement and Record of Decision [2006] and the Gallatin National Forest Noxious and Invasive Weed Treatment Project Environmental Impact Statement and Record of Decision (2005)]. Protection and prevention measures outlined in these applicable forestwide weed management National Environmental Policy Act decisions provide invasive plant species management direction.

Key Indicators and Measures

The following are indicators used for the analysis of invasive plants:

- Acres of invasive plants projected to be treated as outlined by alternative objectives.
- Acres of the Custer Gallatin that are most vulnerable to weed invasion.
- Miles of available motorized roads and trail that could serve as weed spread vectors.
- Acres potentially disturbed by vegetation treatment (timber and fuels) activity that could serve as a correlation to potential for ground disturbance at risk for weed invasion.

Other invasive species such as invertebrates, pathogens and insects will be evaluated qualitatively.

Methodology and Analysis Process

In general, the analysis assumes increased ground disturbance corresponds with increased risk of weed spread. Roads, trails, livestock, and canopy reduction and/or ground disturbance from fire and vegetation management can provide ideal pathways for the introduction of invasive species. Invasive plant species can displace at-risk and other native species through competitive displacement. Competition from invasive non-native species and noxious weeds can result in the loss of habitat, loss of native pollinators, and decreased at-risk plant species persistence. Subsequent impacts from management actions include herbicide spraying and mechanical ground disturbance to control noxious weeds once they gain a foothold.

Information Sources

The Montana and South Dakota Noxious Weed Lists are used to identify which invasive species to manage across the Custer Gallatin National Forest, as well as project specific invasive plant risk assessments (risk assessments). Risk assessments help identify threats to native vegetation as a result of project related ground disturbance and invasive species within or near the project area. They also prescribe mitigation measures to reduce these threats. As project areas are surveyed, new infestations are inventoried. These data are entered into the Natural Resource Manager’s Threatened, Endangered, and Sensitive Plants, and Invasive Species database, a system of database tools for managing Agency data across the Custer Gallatin National Forest. Invasive plant infestation data (spatial and tabular) is stored and can be retrieved for later reference and analyses. This database has been continually updated with inventoried infestations. Invasive plant treatments are also recorded and entered into the Natural Resource Manager System, which allows the Forest to track invasive plant treatment accomplishments.

Analysis Area

The geographic scope of the analysis for invasive species are the National Forest System lands of the Custer Gallatin National Forest. This area represents the lands where changes may occur to vegetation as a result of management activities or natural events. For cumulative effects, the analysis area also includes the non-National Forest System lands within and adjacent to the administrative boundary of the Custer Gallatin National Forest. The temporal scope is the life of the plan.

3.9.2 Affected Environment (Existing Condition)

Invasive Terrestrial and Aquatic Plants

Nonnative invasive plant species, including those that are formally designated by states as noxious weeds, have disrupted natural processes on nearly 100 million acres in the United States and are spreading at an estimated rate of 14 percent per year (USDA 2001). On National Forest System lands in the United States noxious weeds have been estimated to be increasing at 8 to 12 percent per year (USDA Forest Service 1998). The most widespread weed in Montana is spotted knapweed. It has been estimated that spotted knapweed has increased at a rate of 27 percent per year (Sheley et al. 2011).

Weed management have evolved over time to overall ecosystem response to weed management and not simply by the degree to which the target weed is suppressed. Using tools without carefully considering the collective outcome can actually make conditions worse (Pearson and Callaway 2003) (Lehnhoff et al. 2008). Understanding the ecology of the ecosystems, the nature of the threats to be mitigated, and the efficacy of the tools employed improves ecosystem management when considering the following factors: invader impacts such as reduced abundance of individual native organisms and altered community interactions, management side effects such as reduced vigor or abundance of native or desirable species, and secondary invasion such as when the suppression of the target weed results in the proliferation of another invader (Pearson and Ortega 2009).

Part of understanding overall ecosystem response to weed management actions includes understanding concepts of weak versus strong invaders. The majority of invader species that establish within native communities tend to be ‘‘weak’’ invaders that coexist with native species as minor community components (Huston 1994, Davis et al. 2000, Brown and Peet 2003, Ortega and Pearson 2005). However, ‘‘strong’’ invaders that attain community dominance can dramatically impact native species and processes (Williamson and Fitter 1996, Levine et al. 2003, Ortega and Pearson 2005). It is widely recognized that invader species threaten biological diversity and the functioning of natural ecosystems. Strong invaders are the primary basis for this threat. Studies in bunchgrass communities in western Montana found that measures of native species diversity and susceptibility to invasion were positively correlated in communities with low levels of invasion where both weak and strong invaders occurred at low densities, but negatively correlated in communities with high levels of invasion where the strong invader of spotted knapweed dominated (Ortega and Pearson 2005). Given the increasingly serious threat of strong invaders to diversity and function of natural ecosystems and the difficulties associated with reversing these impacts, invasion ecology is shifting away from the current debate over the biotic resistance hypothesis (which predicts that the more diverse communities should be less susceptible to invasion) to developing an understanding of the behavior of weak versus strong invaders. Regardless of diversity, few natural communities can escape the entry of invasive species and the impact of strong invaders (Ortega and Pearson 2005) Another study in west-central Montana identified found that local invader abundance (canopy cover) had a significant influence on the likelihood of impact, but range (number of plots occupied) did not. This study also found that the noxious weed list captured 45 percent of the high-impact invaders, but missed 55 percent suggesting that noxious weed lists help guide invasive species management, but that an understanding of susceptibility to invasion is important for weed management (Pearson et al. 2016).

Numerous studies describe the ecological impacts of invasive weeds when they are at high density levels. Most infestations on the Custer Gallatin are at low densities but there are occasional high density infestations. Regardless of density, weeds are very expensive to control, and native plants are difficult to restore.

Ecological impacts of weeds at high density levels include a reduction in forage for livestock and wildlife. Research has indicated that elk will use knapweed and cheatgrass, but native grasses make up the majority of the diet (Kohl et al. 2012). Herbicide treatment of spotted knapweed increased perennial grass biomass by 7.5 times where knapweed density averaged 36 mature plants per square meter – more than 60 percent canopy cover (Sheley et al. 2000). This is an indication of the amount of native grass that is lost with high density levels of spotted knapweed.

High density levels of spotted knapweed have been found to increase surface run off and stream sediment levels, and to change soil nutrients. For example, changes in phosphorus were detected when spotted knapweed canopy cover was 60 to 80 percent (Thorpe et al. 2006). Likewise, research studies found an increase in surface runoff and sediment in sites of heavy knapweed infestation (90 percent) compared to sites in which native grasses dominate (Lacey et al. 1989). The runoff was 56 percent higher and the stream sediment yield was 196 percent higher on sites dominated by spotted knapweed compared to sites dominated by native bunchgrasses. Water infiltration was greater on sites with grasses than on sites with spotted knapweed.

Weeds can also change the frequency and severity of wildland fires. Cheatgrass has been found to increase fire frequency in areas where it is abundant (Balch et al. 2013). The more frequent fires are causing populations of native grasses and shrubs to decrease and the cheatgrass to increase.

Currently there are 53 invasive species listed for the Montana and South Dakota portions of the Northern Region, including lists from states, counties, and other national forests. Of these, 33 species are currently known to be on the Custer Gallatin National Forest. The status of each invasive plant species is considered when determining the appropriate management strategy and priority. Some of the most common species are spotted knapweed, Canada thistle, hounds-tongue, nodding thistle, leafy spurge, cheatgrass, yellow toadflax, and Dalmatian toadflax. Species that are particularly aggressive and have a high risk of outcompeting native vegetation are of highest priority for treatment and containment are spotted knapweed, leafy spurge, toadflax species (yellow and Dalmatian), orange hawkweed and meadow hawkweed; as well as those species that are on the State noxious list but not currently present on the Custer Gallatin National Forest (for example, yellow starthistle). Reduction of particularly aggressive species is critical for the protection of intact plant communities and associated habitats. Avoiding the establishment of additional species is equally important in the maintenance of healthy landscapes.

Presence and amount of invasive species and noxious weeds is a key indicator for overall ecosystem health. The 2016 watershed condition framework assessment for the Forest identified that most noxious weeds affect less than 10 percent of each individual watershed (sixth code hydrological units). However, six watersheds were identified as having a noxious weed footprint of between 21 and 54 percent of the watersheds. Weeds in Lower Mill watershed (Yellowstone District and Bloom Creek, Paget Creek, and Horse Creek watersheds (Ashland District) were exacerbated by wildfires in those areas. Some weeds in these areas have been treated, but seed banks likely exist where weeds can persist over time. As infestations increase in size, a containment strategy is typically used to treat the periphery of the area rather than attempting eradication, which is generally not feasible given limited resources. Biological control with insects and goats have been used to manage more dense infestations.

Species that have limited occurrence, in either number of acres or number of sites, are considered new invaders. New invaders on or near the Custer Gallatin include hawkweeds (both orange and meadow), tamarisk, Eurasian water-milfoil, purple loosestrife, blueweed, knotweed, yellow starthistle, and dyer's woad.

Given the limited funding levels, the Custer Gallatin has developed a management strategy that gives priority to new invaders, and secondary priority to treatment of areas impacted by construction and vegetation projects, and spread vectors such as roadsides and recreation sites, along with areas with specific funds designated for treatments.

There are some areas where nonnative species such as timothy grass, smooth brome, Kentucky bluegrass, and crested wheatgrass occur. Due to old reseeding practices on a minor part of the landscape, some areas have smooth brome (all geographic areas) or crested wheatgrass (minor amounts in the Sioux geographic area). Due to adjacent land activities during settlement and historic grazing overuse at the turn of the 20th century, some areas have large amounts of Kentucky bluegrass (all geographic areas), and timothy grass (all montane geographic areas) as part of the landscape. The problem with these species is that they can form monocultures to the exclusion of most native species.

There is an estimated 57,600 acre known footprint of noxious weed infested area on the Custer Gallatin (less than 2 percent of the national forest). Not all of the Custer Gallatin has been surveyed so there is the potential for additional infestations to exist in areas that have not been surveyed. Table 50 displays the amount of inventoried noxious weeds (infested acres), by species for each geographic area.

Table 50. Acres of Montana and South Dakota state and county listed noxious weeds (net infested acres) for each geographic area

Species	Sioux	Ashland	Pryor Mountains	Absaroka, Beartooth Mountains	Bridger, Bangtail, Crazy Mountains	Madison, Henrys Lake Gallatin Mountains
Absinthium (*Artemisia absinthium*) (noxious in Carbon Co., MT and noxious in SD)	87	no data	no data	under 1	no data	no data
Hoary alyssum (*Berteroa incana*) (noxious in MT)	no data	no data	under 1	64	1	690
Cheatgrass (*Bromus tectorum*) (Regulated in MT)[1]	no data	no data	no data	1,819	no data	331
White top (*Cardaria dradba*) (noxious in MT & SD)	no data	no data	under 1	2	under 1	36
Nodding thistle (*Carduus nutans*) (noxious in SD & noxious in Gallatin Co., MT)	5	no data	no data	2,432	2,463	976
Spotted knapweed (*Centaurea maculosa*) (noxious in MT & SD)	689	5,607	769	6,153	275	2,416
Diffuse knapweed (*Centaurea diffusa*) (noxious in MT & SD)	no data	no data	no data	no data	no data	1
Russian knapweed (*Centaurea repens*) (noxious in MT & SD)	under 1	19	no data	no data	under 1	under 1
Oxeye daisy (*Chrysanthemum leucanthemum*) (noxious in MT & SD)	no data	no data	24	377	233	362

Species	Sioux	Ashland	Pryor Mountains	Absaroka, Beartooth Mountains	Bridger, Bangtail, Crazy Mountains	Madison, Henrys Lake Gallatin Mountains
Canada thistle (*Cirsium arvense*) (noxious in MT & SD)	4,148	37	871	5,948	1752	1,176
Bull thistle (*Cirsium vulgare*) (noxious in SD)	7	no data	no data	1,321	201	20
Poison hemlock (*Conium maculatum*) (noxious in Gallatin, Powder River, & Rosebud Co.'s, MT, and noxious in SD)	no data	no data	no data	no data	no data	11
Field Bindweed (*Convolvulus arvensis*) (noxious in MT & SD)	51	no data	552	160	no data	1
Houndstongue (*Cynoglossum officinale*) (noxious in MT & SD)	368	2	403	5,258	2515	1109
Leafy spurge (*Euphorbia esula*) (noxious in MT & SD)	491	6,350	3	553	96	25
Orange hawkweed (*Hieracium aurantiacom*) (noxious in MT)	no data	no data	no data	73	21	22
Meadow hawkweed (*Hieracium* spp.) (noxious in MT)	no data	no data	under 1	46	no data	1
Black henbane (*Hyoscyamus* niger) (noxious in Stillwater & Powder River Co.'s, MT and noxious in SD)	no data	no data	no data	101	no data	no data
St. Johnswort (*Hypericum perforatum*) (noxious in MT & SD)	no data	12	no data	60	15	2
Field scabiosa (*Knautia arvensis*) (noxious in Gallatin Co., MT)	no data	no data	no data	no data	under 1	5
Dalmatian toadflax (*Linaria dalmatica*) (noxious in MT & SD)	no data	no data	418	770	under 1	91
Yellow toadflax (*Linaria vulgaris*) (noxious in MT & SD)	no data	no data	no data	848	481	825
Sulfur cinquefoil (*Potentilla recta*) (noxious in MT & SD)	under 1	no data	no data	324	74	26
Tall buttercup (*Ranunculus acris*) (noxious in MT)	no data	no data	no data	20	no data	under 1
Tamarisk (*Tamarix* spp.) (noxious in MT & SD)	no data	under 1	no data	no data	no data	under 1
Common tansy (*Tanacetum vulgare*) (noxious in MT & SD)	no data	no data	no data	271	50	38
Common mullein (*Verbascum thapsus*) (noxious in Stillwater Co., MT and noxious in SD)	12	1	no data	516	166	138
Total infested acres (2018 data)[2]	**5,863**	**12,032**	**3,046**	**27,119**	**8,348**	**8,302**

1. Cheatgrass (*Bromus tectorum*) in Montana is considered a "regulated plant" and not a listed noxious weed. Regulated plants have the potential to have significant negative impacts. The state recommends research, education and prevention to minimize the spread of this species.
2. There are 64,710 total infested acres, which include overlapping species-specific infestations (57,612 total footprint without overlapping acres)

Since each area of the Custer Gallatin National Forest is distinct with respect to invasive weeds, a more detailed description is provided below.

Sioux Geographic Area

The Sioux Ranger District includes 174,758 acres and 99 percent is vulnerable habitat with 4 percent of the vulnerable area being infested. Infestations of Canada thistle, leafy spurge, spotted knapweed, absinthium wormwood and houndstongue occur in disturbed areas. Wildland fires have exacerbated weeds such as leafy spurge in the Ekalaka Hills and Canada thistle and spotted knapweed in the Long Pines.

Ashland Geographic Area

The Ashland Ranger District includes 496,558 acres and 99 percent is vulnerable habitat with three percent of the vulnerable area being infested. Most common weed species include spotted knapweed, leafy spurge, Russian knapweed, and St. Johnswort. Large forest fires have caused a substantial increase in spotted knapweed and leafy spurge. New invader species include tamarisk and sulfur cinquefoil.

Pryor Mountains Geographic Area

The Pryor Mountains includes 77,944 acres, and 74 percent is vulnerable habitat with 3 percent of the vulnerable area being infested. Most common weed species include spotted knapweed, Canada thistle, houndstongue, leafy spurge, field bindweed and Dalmatian toadflax. New invader species include meadow hawkweed and oxeye daisy.

Absaroka Beartooth Mountains Geographic Area

The Absaroka Beartooth Mountains geographic area includes two mountain ranges totaling 1,459,500 acres; about 13 percent of this area is vulnerable to invasive plants with 11 percent of the vulnerable area being infested. Large infestations of invasive plants occur mostly in disturbed areas and along motorized routes. Other disturbances are from large forest fires, recreational activities (campsites, trailheads, developed recreational areas, fishing access), timber harvest, and livestock grazing. New invaders include orange hawkweed.

Bridger, Bangtail, and Crazy Mountains Geographic Area

This area includes three mountain ranges and includes 321,701 acres; about 60 percent is vulnerable habitat with two percent of the vulnerable area being infested. Large infestations of thistles, houndstongue, spotted knapweed, and oxeye daisy occur in disturbed areas. Many of the weeds are on old logging areas, livestock allotments and on lands acquired through land exchanges. New invaders include orange hawkweed, leafy spurge, and St. Johnswort.

Madison, Henrys Lake, Gallatin Mountains Geographic Area

The Madison, Henrys Lake ,Gallatin Mountains geographic area includes three mountain ranges totaling 952,813 acres; about 42 percent of this area is vulnerable to invasive plants with two percent of the vulnerable area being infested. Large infestations of invasive plants occur mostly in disturbed areas and along motorized routes. Other disturbances are from large forest fires, recreational activities (campsites, trailheads, developed recreational areas, fishing access), timber harvest, and livestock grazing. New invaders include orange hawkweed, blueweed (adjacent to the national forest), dyer’s woad, field scabiosa, tall buttercup, Eurasian watermilfoil (adjacent to the national forest), tamarisk, and yellow starthistle.

Other Areas of Interest

Designated and other areas of interest on the Custer Gallatin where the presence of invasive plants may substantially compromise ecological integrity and habitat quality include the two wilderness areas, the wilderness study area, Forest Service recommended wilderness areas, inventoried roadless areas, research natural areas, botanical special areas, and areas of important wildlife habitat (such as sage grouse habitat and elk winter range). Table 51 lists the current level of weeds for each of these areas.

Table 51. Acres of inventoried invasive weeds in wilderness areas, roadless and recommended wilderness areas, research natural areas, elk winter range, and sage grouse habitat[1]

Infested Areas	Sioux	Ashland	Pryor Mountains	Absaroka Beartooth Mountains	Bridger Bangtail, Crazy Mountains	Madison, Henrys Lake, Gallatin Mountains
Wilderness Areas	not applicable	not applicable	not applicable	Absaroka Beartooth 2,123 acres	not applicable	Lee Metcalf 56 acres
Wilderness Study Area	not applicable	not applicable	not applicable	not applicable	not applicable	Hyalite / Porcupine / Buffalo Horn 186 acres
Roadless and Recommended Wilderness	not applicable	King Mountain 9 acres	Lost Water Canyon 17 acres	Chico Peak 44 acres, Beartooths less than 1 acre, Black Butte 11 acres, Fishtail Saddleback 1 acre, Line Creek Plateau 35 acres, Burnt Mountain 14 acres, North Absaroka 5,653 acres, Red Lodge Hellroaring 408 acres	Bridgers 92 acres Crazy Mountain 525 acres	Dry Canyon 3 acres, Reef 14 acres, Cabin Creek Wildlife Management Area 41 acres, Gallatin Fringe 65 acres, Lionhead Roadless 45 acres, Lionhead Recommended 3 acres Madison 276 acres
Research Natural Areas and Special Areas	not applicable	Poker Jim Research Natural Area no acres inventoried	Lost Water Canyon Research Natural Area 1 acre	Line Creek Research Natural Area 8 acres, Sliding Mountain Research Natural Area 2 acres	Bangtail Botanical and Paleontological SA 447 acres	Black Sands Spring Botanical Study Area 1 acre, East Fork Mill Creek Research Natural Area 5 acres, Obsidian Sands Research Natural Area less than 1 acre
Percent of elk winter ranges with weed infestations and # of acres infested	not applicable	not applicable	not applicable	Big Timber – 2 percent (1,643 acres) Paradise Gardiner- 4 percent (7,064 acres) Beartooth 6 percent (4,349 acres)	Bridgers under 1 percent (230 acres) Crazy under 1 percent (116 acres)	Gallatin Madison – 2 percent (1,655 acres) Hebgen – 3 percent (2,454 acres)
Percent of Sage grouse priority and general habitat with weed infestations and number of acres infested	Over 1 percent of sage grouse general habitat is infested (28 acres) and 6 percent of sage grouse priority habitat is infested (96 acres)	3 percent of sage grouse general habitat is infested (3,058 acres).	Under 1 percent of sage grouse general habitat is infested (70 acres).	No infestations recorded in the general habitat	No infestations recorded in the general habitat	7 percent of sage grouse general habitat is infested (201 acres)

1. All weed infested acres were dissolved so overlapping areas were not double counted.

Vulnerable Habitats

Another useful attribute for describing the current weed infestation problem is to consider the number of acres infested compared to the potential acres of vulnerable habitat. Each weed species has a preferred habitat where the weeds will thrive and out-compete the native plants. Given the parameters of canopy cover, elevation and aquatic and riparian habitat almost all areas are vulnerable except for dense forest (canopy cover greater than 60 percent) and areas above 9,000 feet.

Vulnerable areas may develop large infestations of weeds that alter ecological processes or site productivity. Conversely, areas not vulnerable have few or no weeds, and weeds that are present are generally limited to highly disturbed areas. Table 52 lists the total acreage for each area, the acreage of vulnerable habitat, and the current footprint of weed acreage.

Table 52. Vulnerable habitat (acres - all terrestrial and aquatic habitat less than 9,000 feet and less than 60 percent canopy cover) and current infestation footprint (acres)[1]

Attribute	Sioux	Ashland	Pryor Mountains	Absaroka Beartooth Mountains	Bridger, Bangtail, Crazy Mountains	Madison, Henrys Lake, Gallatin Mountains
Total Acres	178,625	501,596	77,944	1,459,500	321,701	952,813
Acres of vulnerable habitat	174,758 99 percent of total area	496,558 99 percent of total area	58,063 74 percent of total area	187,805 13 percent of total area	192,680 60 percent of total area	395,706 42 percent of total area
Acres Infested footprint	7,477 acres 4 percent of vulnerable area	16,122 acres 3 percent of vulnerable area	2,025 acres 3 percent of vulnerable area	19,812 acres 11 percent of vulnerable area	4,485 acres 2 percent of vulnerable area	7961 acres 2 percent of vulnerable area

1. Acreages are likely underestimations since not all acres have been inventoried.

Climate Change

Climate change is likely to result in differing responses among invasive plant species, due to differences in their ecological and life history characteristics. Climate change could result in either range expansion or contraction of an invasive species (Halofsky et al. 2018a). For example, modeling indicates that leafy spurge is likely to contract and spotted knapweed is likely to shift in range. Invasive species are generally adaptable, capable of relatively rapid genetic change, and many have life history strategies (such as, prolific seed production, extensive deep roots) which can enhance their ability to invade new areas in response to changes in ecosystem conditions. Warmer temperatures, and associated drier conditions, more severe or frequent droughts, and more favorable conditions for wildland fire may increase the ability of invasive plants to establish and out-compete native plants. These changes may provide more opportunities for invasive plants to gain an advantage over native species, and spread within and beyond the Custer Gallatin National Forest’s boundaries. This potential effect is common to all alternatives.

Studies have shown that elevated carbon dioxide levels can lead to a reduction in herbicide efficacy (Ziska and R. 2000, Ziska 2010). Reduced treatment effectiveness coupled with the potential for increased opportunities for growth and vigor has the potential for invasive plants to gain an even greater advantage over native species.

The effects of climate change on species' distributions are likely to be complex given the potentially differing climatic controls over upper and lower distribution limits (Harsch and Ris Lambers 2015). Some studies predict a movement in some invasive plant species range closer to the poles or upward in elevation (Chen et al. 2011). Some studies suggest that the threat posed to high-elevation biodiversity by invasive plant species is likely to increase because of globalization and climate change(Pauchard et al. 2009). Other studies suggest that distribution shifts in response to recent climate change could occur in either direction (upward or downward)(Harsch and Ris Lambers 2015).

Fire is another factor affected by climate change. When combined with climate change, fire/invasive plant relationships may be exacerbated leading to greater invasive species populations and spread. Other disturbances or shifts in historical patterns may be affected by climate change and in turn affect the spread of invasive species. As the agency responds to climate change by new, different, or more land and vegetation management actions, those disturbances could provide suitable conditions for invasive plants.

Aquatic Invasive Species

Aquatic invasive species damage ecosystems and threaten commercial, agricultural, and recreational activities. High densities of aquatic invasive plants can decrease the quality of fishing and swimming areas, and such infestations have been found downstream of the Custer Gallatin National Forest area. Eurasian watermilfoil will form dense mats of vegetation that provide poor habitat for waterfowl and fish, alter water quality by raising pH, decrease oxygen, increase water temperature, and limit access for fishing and swimming (Williamson and Fitter 1996, Parkinson et al. 2010, Parkinson et al. 2016). This plant was found in the Madison River and Jefferson River in 2010, and also present in Carbon and Stillwater Counties, Montana. Curly leaf pond weed is another aquatic invasive weed that has similar ecological impacts as Eurasian watermilfoil (Parkinson et al. 2016) and it was found in Hebgen Lake, MT in 2011. In South Dakota, curly leaf pondweed has spread to at least three of four Missouri River reservoirs and several reservoirs within the Black Hills. Purple loosestrife was first found in Montana in 1992 in the western part of the state; now it is present in Meagher, Carbon and Rosebud Counties, Montana. Tamarisk is yet another invasive weed that forms thick clumps of vegetation adjacent to stream banks; the plant limits access to streams and displaces native plants. Tamarisk was first discovered in Montana in 1971 and now is present in more than eight counties; small infestations were found on both the Ashland and Beartooth Ranger Districts.

Other aquatic invasive species are present in a few locations on the Custer Gallatin, and prevention of their spread as well as new introductions is an ongoing management concern (Montana Fish Wildlife and Parks 2016). Among species documented on the Custer Gallatin, are New Zealand mudsnails (*Potamopyrgus antipodarium*), and American bullfrog (*Lithobates catesbiana*) (Montana Fish Wildlife and Parks 2016). The former species occupy Hebgen and Quake Lake, and New Zealand mudsnails are present in the Yellowstone River reaches near the Custer Gallatin. The spread of aquatic invasive species can occur through various vectors including moving watercraft between water bodies without removing invasive plants and animals, and releasing bait into water bodies. American bullfrog is present in the Stocker Branch above Blacks Pond; the species was apparently introduced into a private pond many years ago. Additionally, bullfrogs are present and spreading in the Yellowstone River system near Billings, Montana (Sepulveda et al. 2014) and as such could eventually reach national forest lands in other locations. The Yellowstone River has a new (or species which has been present for some time, but warmer water temperatures and lower base flows have allowed it to thrive) invasive species, *Tetracapsula bryosalmonae*, which can infect a variety of fish species and result in proliferative kidney disease. An outbreak in the Yellowstone River occurred in August 2016, killing thousands of fish. The South Dakota Department of Game, Fish and Parks and Montana Fish Wildlife and Parks have aggressive programs to educate the public, require boat and equipment disinfection to help stop the spread of aquatic invasive species.

Emerald Ash Borer

The emerald ash borer (*Agrilus planipennis*), a beetle native to Asia, was first found in North America in 2002 in southeastern Michigan. Across the United States, emerald ash borer has killed tens of millions of ash trees and poses a serious threat to the green ash resources. The broad distribution of emerald ash borer is largely due to the inadvertent movement of infested ash commodities, especially before its original detection. Emerald ash borer was recently detected in eastern South Dakota and northern Colorado, and could pose serious threat to the health of green ash resources on the Sioux and Ashland Districts if transported to the area. In its native range emerald ash borer does not cause serious damage to ash trees, however, due to lack of host resistance by North American ash trees as well as lack of predators and parasitoids, emerald ash borer has had a significant impact on the ecology and economy of infested areas. Near the Sioux Ranger District, South Dakota Department of Game, Fish and Parks restricts the import of out-of-state firewood or from quarantined areas within the state, to help prevent the spread of emerald ash borer.

White Pine Blister Rust

White pine blister rust is a non-native disease that entered the U.S. at the turn of the 20th century. Its primary host species on the Custer Gallatin are whitebark pine and limber pine. It also infects ribes species (currants and gooseberries), and possibly louseworts and Indian paintbrush, which are alternative hosts required for the disease to complete its life cycle. As blister rust has moved into fragile, high-elevation ecosystems, successional pathways have been altered, hastening the conversion to climax species such as subalpine fir. Blister rust infections range in severity, but often progress from infecting and girdling branches to killing trees of all sizes over time. Surviving trees are weakened and susceptible to other mortality agents such as the mountain pine beetle. The interaction of warming climates, mountain pine beetle, fire exclusion (which has allowed shade tolerant species to out-compete whitebark pine), and blister rust has resulted in a bleak outlook for whitebark pine in many areas.

Because it is non-native, all levels of blister rust infection are outside the natural range of variation. There is no known method for eradicating the disease, although actions such as pruning can reduce infections. A small percentage of host trees display one or more resistance traits that enable them to avoid or survive infection; encouraging regeneration (natural or artificial) from these seed sources provides hope for perpetuation of the species. There is currently no statistical means to estimate blister rust infection or hazard across the Forest. Based on field experience, however, white pine blister rust is generally present wherever five-needled pines are found. Many of these forests have become dominated by snags, with only a few seed-bearing survivors that possess one or more resistance traits. Still, in many areas, seedlings continue to establish.

There is a great deal of uncertainty surrounding climate change and its potential effect on vegetation conditions. Whether it is invasive species such as white pine blister rust or other stressors such as drought, uncharacteristic wildfires, elevated native insects and disease levels, unusually high forest densities, or some other agent or combination of agents that serves to stress trees and forest ecosystems; recent research suggests that climate change will likely exacerbate those stressors and "stress complexes" will continue to manifest themselves (Halofsky and Peterson 2016).

White-Nose Syndrome

Several bat species, particularly those in the genus *Myotis*, are vulnerable to White-Nose Syndrome, a disease that is caused by a fungus (*Pseudogymnoascus destructans)* (*Pd*) that can be transmitted by other bats as well as by humans visiting caves where bats are roosting. The disease erodes bat skin tissue and often appears white when it infects the skin of the nose, ears, and wings of hibernating bats. Migrating bats carry spores hundreds of miles. Spores can be found in cloth and people (cavers, researchers and casual visitors) can inadvertently spread it by visiting affected sites and then unaffected sites (caves, mines, or buildings where bats hibernate). Millions of bats in northeast US and Canada are being lost to white-nose syndrome with experts being concerned that some bats are becoming extinct in certain regions. Currently, white-nose syndrome has not yet been detected in Montana but was recently confirmed in the Black Hills National Forest in South Dakota just south of the Sioux District. The disease was also recently confirmed at Badlands National Park in South Dakota and the Fort Laramie National Historic Site in eastern Wyoming. Any entity wishing to capture, handle, or inventory bats on the South Dakota portion of the Sioux Ranger District, must obtain a permit from the South Dakota Department of Game, Fish and Parks and follow guidelines to avoid the spread of *Pd*.

3.9.3 Environmental Consequences

Invasive species cause undesirable ecological impacts. Species arrived in this country with few or no natural pathogens or controlling agents such as insects; consequently, they increase in density and out-compete native species. Terrestrial and aquatic noxious weeds are capable of successfully expanding their populations into new ecosystems and can create lasting negative impacts to native plant communities. Impacts from noxious weeds can be exacerbated by fire, native pests, weather events, human actions, and environmental change (U.S. Department of Agriculture 2013). It is still unknown what the total consequences of white-nose syndrome has on various bat species, but it poses a substantial threat.

All Alternatives

Management Direction under All Alternatives

The Records of Decision for noxious weed control signed for the Gallatin and Custer national forests in 2005 and 2006, respectively, would continue to be implemented under all alternatives. These decisions implement an integrated pest management approach. These weed control decisions also adopts an adaptive management approach to new infestations and broadens herbicide application methods to include aerial treatment options as well as provides the ability to apply herbicide in wilderness areas. The analysis in the FEISs also evaluated the use of new herbicides and imposed new environmental safeguards. Existing and newly approved biological control agents can also be applied to infestations where appropriate. The selected alternatives contained environmental protection measures to reduce non-target species exposure to herbicides caused by spray drift through wind speed restrictions during application, buffering of sensitive areas, weather monitoring, boundary marking, and restrictions on areas to be sprayed, and use of drift reduction agents.

To avoid the spread of non-native disease, pathogens, or other taxa to native wildlife, the state wildlife agencies require permits to capture, handle, or collect species. States require permit holders to follow state protocol. On bodies of water managed by or jointly managed with States, there are requirements to disinfect boats and equipment.

Effects Common to All Alternatives

Noxious and other invasive weeds have the potential to substantially outcompete native vegetation and forage when left unchecked. Impacts are similar between all alternatives, including the current plans. Invasive plants will continue to have a presence on the Custer Gallatin National Forest landscape, with existing infestations and continual introductions of new invaders. Some invasive species have become “naturalized” to vegetation communities on the Custer Gallatin National Forest, and some level of their presence will persist in all alternatives. Canada thistle, cheatgrass, houndstongue, Kentucky bluegrass, smooth brome, and timothy are all examples of invasive species that have spread too many herbaceous plant communities across the Forest. Infestations, known and yet to be discovered, are a concern for weed managers under all alternatives. Management under alternatives would attempt to slow the spread and introductions of new invaders as well as prevent existing weed species from establishing to new non-infested areas. The Custer Gallatin National Forest will continue to conduct weed treatments with the most effective options (chemical, mechanical, and biological) as they become available and to implement mitigations such as the weed-free forage program, use of weed-free sires during fire and other incidents, and vehicle washing/inspections for contract work.

Invasive plants have increased across the Custer Gallatin National Forest, with a present infestation footprint of approximately 57,600 acres. Assuming that the national average annual rate of spread of 8 to 12 percent applies, the Custer Gallatin National Forest can expect to encounter an increase in invasive plant infestations at a rate of up to approximately 4,600 to 6,900 acres per year.

Of additional importance is the current and predicted continuation of globalization, or the free movement of goods, capital, services, people, technology, and information. Globalization processes will most likely significantly affect the States of Montana and South Dakota, especially as the human population continues to grow. Globalization facilitates and intensifies the spread of invasive alien species (Meyerson and Mooney 2007). As a result, the extent and density of invasive plant infestations as well as the number of invasive plant species has the potential to increase on the Custer Gallatin.

Current Plans

Management Direction under the Current Plans

The 1986 Custer and 1987 Gallatin Forest Plans are similar with respect to invasive plants and noxious weeds. Both forest plans direct managers to use an integrated pest management program to control noxious weeds and to work with partners (other agencies and adjacent land owners) to control weeds. Differences between the two forest plans include the following:

The Custer forest plan prioritizes control based on size of infestation; focused on eliminating new starts and small infestations. For bigger patches, containment or reduction in size is specified (Custer forest plan, pp. II-3 and II-24). This element of the forest plan provides consistent direction for the strategy and priority of treatment areas across the national forest.

The Gallatin forest plan standard states that funding for weed control on disturbed sites will be provided by the resource that causes the disturbance (Gallatin forest plan, 2015 amended, p. II-32). This forest plan standard provides incentive for all resource areas to minimize the spread of weeds and to help fund weed control.

Forestwide environmental impact statements for weed management were completed on both national forests (Custer National Forest 2006, Gallatin National Forest 2005) and provide further direction. They adopted an adaptive strategy to determine where, when and how to treat sites, considering such factors as weed species and treatment prioritization, ecological importance of the site and funding.

Neither of the current plans contain direction related to aquatic invasive species, emerald ah borer or white nose syndrome.

Effects of the Current Plans

In spite of its lack of specificity in the actual 1985 and 1986 forest plan direction, as amended, the current plans encompass current practices and is considered appropriate to address invasive plant species while being flexible to budget constraints. Prioritizing treatment areas and control strategies have been effective only to the extent that resources have been available to implement them. There is still a trend of increasing weed introduction and spread given limited resources for prevention and treatment.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

The purpose of the invasive species plan components is to ensure that all Forest Service management activities are designed to minimize or prevent establishment or spread of invasive species on national forest lands, or to adjacent areas, and to provide for healthy resilient and resistant ecosystems.

All the revised plan alternatives contain multiple-use resource management objectives with varying degrees of forest vegetation management. Timber production, livestock grazing, and recreational activities continue to provide endpoints for introduction and subsequent seed dispersal, as well as the environmental disturbance that enhances germination and establishment of non-native plants.

The revised plan alternative components require mechanisms for addressing aquatic invasive species. More general or universal procedures, such as using current best practices for equipment washing before and after entering an area, are included in the management approaches appendix (appendix A) of the draft revised forest plan.

The revised plan alternatives provide a goal and management actions for providing educational prevention information if emerald ash borer does become discovered in or near the Forest. The draft revised forest plan’s appendix A Management Approaches provides educational prevention information and guidance if emerald ash borer does become discovered in or near the Forest. The National Response Framework for Emerald Ash Borer is intended to assist the Forest to prepare for and respond to Emerald Ash Borer by providing an overview of the resources available and guidance in obtaining additional information.

As outlined in the draft revised forest plan’s appendix A management approaches, the United States National White-nose Syndrome Decontamination Protocol (U.S. Department of the Interior 2016b) is intended to assist the Forest to prepare for and respond to white-nose syndrome by providing decontamination procedures to effectively clean and treat clothing, footwear, and/or equipment that may have been exposed to the fungus. Management approaches also include prevention measures and educational messages in limiting white-nose syndrome spread.

Effects Common to all Revised Plan Alternatives

Invasive Plants

Noxious weed management would continue under direction of both the Gallatin National Forest Weed Environmental Impact Statement (2005) and the Custer National Forest Weed Environmental Impact Statement (2006), until revised. Any subsequent decisions would continue to provide additional direction. Infestation levels of invasive plants would likely remain steady to slightly increasing over time. The rate of increase would be higher under alternative E than the other alternatives due to lower treatment objectives. Some species may contract in density as new treatment and biological options become available, while other weeds would expand in range and density.

As a result of these plan components, all habitats would be expected to benefit from the reduction of invasive species, particularly in wetland/riparian and grasslands/shrublands. The revised plan alternatives provide similar protections and guidelines for invasive species treatment as the existing plans.

Aquatic Invasive Species

The current Forest Plans do not contain specific standards or guidelines related to aquatic invasive species. Spread and introduction vectors are inherent to most projects and types of forest use. The revised plan alternative plan components are included as resource protection measures at the project level. These activities would include, but are not limited to: proactive measures to avoid accidental introduction, transporting water across drainage boundaries for fire suppression, constructing stream fords, operating equipment in a riparian area and near a water course, and the use of pumps and sumps for fire suppression, or construction related dewatering activities.

Emerald Ash Borer

The current Forest Plans do not contain specific standards or guidelines related to emerald ash borer. Spread and introduction vectors are not inherent to most projects or forest use. However, the distribution of emerald ash borer is largely due to the inadvertent movement of infested ash commodities such as unprocessed logs, firewood, or pallets. The revised plan alternative components include goals for prevention and interagency coordination. Goals and the information in appendix A, Management Approaches can better equip the Forest Service for their efforts to proactively manage to avoid this insect, and then prepare for and/or respond to emerald ash borer impacts, and minimize those impacts and costs.

White Pine Blister Rust

The current Forest Plans do not contain specific standards or guidelines related to white pine blister rust and its relationship to five-needle pines such as whitebark pine. The revised plan alternative components include specific targets for treatments of at-risk species, including whitebark pine which includes white pine blister rust considerations.

Goals and management approaches for the revised plan alternatives include cooperation with the Greater Yellowstone Coordinating Committee-Whitebark Pine Subcommittee on whitebark pine conservation strategies and adaptive management of habitat which incorporates principles of restoration documented in Whitebark Pine Strategy for the Greater Yellowstone Area and Adaptive Action Plan prepared by the Greater Yellowstone Coordinating Committee Whitebark Pine Subcommittee (2011, 2015) and any new best available science for possible whitebark pine restoration strategies and activities (Keane et al. 2012).

- Promoting rust resistance, by a) supporting selective breeding programs to develop and deploy blister-rust resistant whitebark; b) facilitating and accelerating natural selection for rust resistant trees by reducing competition, providing openings for natural seed dispersal and seedling survival; and c) planting seedlings from trees known to have some level of resistance.
- Saving seed sources, by protecting mature seed-producing resistant whitebark pine trees so that apparent rust-resistant seeds can be harvested in the future; and
- Employing restoration treatments, including limiting the spread of blister rust, using fire to encourage regeneration, implementing silvicultural cuttings to reduce competition and increase vigor and reduce likelihood of mountain pine beetle attacks, planting blister rust-resistant seedlings to accelerate the effects of selection, and promoting natural regeneration and diverse age class structures to maintain ecosystem function and reduce landscape level beetle hazard, and to provide large populations for selection for rust resistance.

The revised plan alternatives propose a guideline that when conducting management activities in or near whitebark pine trees or stands identified for collection of scion, pollen, or seed; areas identified as important for cone production or blister rust resistance; and whitebark pine plantations, project-level design criteria or wildland fire management strategies should protect them from potential loss to support the recovery or long-term persistence of this species.

White-nose Syndrome

Spread and introduction vectors are not inherent to most projects or forest use. However, the distribution of white-nose syndrome is largely due to the movement of this non-native fungus from migrating bats that can carry spores hundreds of miles. Spores can be found in cloth and people (spelunkers, researchers and casual visitors) who can inadvertently spread it by visiting affected sites and then introducing the pathogen to unaffected sites (caves, mines, or buildings where bats hibernate or roost. The information in appendix A, Management Approaches can better equip the Forest Service for their efforts to proactively manage to avoid this pathogen and then prepare for and/or respond to white-nose syndrome impacts, and better manage and minimize those impacts and costs.

Effects that Vary by Revised Plan Alternatives

Plan objectives vary in amount of weed treatment, with the lowest objective for acres treated in alternative E. Threats to native vegetation would be reduced by revised plan alternatives B, C, and D and less so in alternative E.

Consequences to Invasive Species from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Timber and Vegetation Management

Ground-disturbing activities, equipment transport and use associated with management activities such as timber harvesting, fire treatments and fire suppression, or other authorized uses are a common vector influencing the expansion of noxious weeds. Most of these risks are minimized with localized site restoration and rehabilitation, as well as the use of weed control and prevention measures during implementation (such as, contract clauses to wash equipment).

Vegetation management activities such as timber harvest, the use of skidders and mechanical harvest techniques and equipment have contributed to the introduction, spread, establishment and persistence on the landscape. Contract specifications help prevent introduction of weed seed to units from outside National Forest System lands by requiring cleaning of equipment. Other weed best management practices include pre- and post-implementation spraying of haul routes, as well as seeding disturbed areas after implementation to prevent establishment of infestations.

For analysis of potential of invasive species spread, the objectives for harvest and fuels treatment acres were used to assume the amount of ground disturbance expected to occur. The direct correlation between ground disturbance and potential of invasive species to establish in those areas was used to differentiate effects between alternatives. Table 53 provides a comparison of the harvest and prescribed fire objectives (acres) per decade by alternative.

Table 53. Acres of objectives for vegetation treament (fuels and timber harvest) per decade by alternative

Objective	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Total Acres of Vegetation Treatment	60,000	60,000	60,000	80,000	50,000

The potential ground disturbing activities associated with overall amount of timber harvest and prescribed fire objects per decade would be similar for the current plans and alternatives B and C, and therefore, potential weed spread would be similar. Alternative D could present more ground disturbing activities with alternative E presenting the least ground disturbance. However, for all alternatives plan components are in place that would limit or mitigate this potential.

Effects from Fire and Fuels Management

Site-specific projects are evaluated under the National Environmental Policy Act (NEPA) for the impact of invasive species and generally projects have requirements to prevent their spread as mitigations for project implementation. For fire treatments, both wildfire, and planned ignitions, invasive species introduction, spread, establishment and persistence has a potential for occurrence. These circumstances result in a change of treatment priorities for the invasive species management program, under all alternatives.

Fire can result in an increase in non-native species diversity and cover, whether it is a prescribed burn or a wildfire (Zouhar et al. 2008). Invasive species such as cheatgrass may alter fire regimes in drier forests, shrublands and grasslands, which comprise much of the Custer Gallatin National Forest.

Wildfires would occur in the future under all alternatives, although uncertainty exists as to extent and location. Weather and climatic factors along with fuels conditions would affect intensity and spread of a fire event. Effects of wildfire on invasive species spread potential is the same across alternatives. Generally, prescribed fire implementation would be similar under all alternatives as well. There is potential for establishment and spread of invasive plant species within burned areas, depending largely upon site-specific conditions, such as fire location, vegetation types that were burned, presence of weed infestations pre-fire, potential vectors, and fire characteristics. Weed infestations within burned areas would be addressed following forest plan management direction, which is similar for all alternatives.

Effects from Watershed, Soil, Riparian, and Aquatic Management

Plan components and activities related to watershed, soil, riparian, and aquatic habitat with the greatest influence are those associated with riparian management zones. The revised plan alternatives would adopt riparian management zones and result in more acres subject to riparian area plan components as compared to the current plans, in which Streamside Management Zones would be used.

With the revised plan alternatives, the use of herbicide treatments within riparian management zones would be limited to instances where they are needed to maintain, protect, or enhance aquatic and riparian resources or to restore native plant communities. Policy, Forest's weed EIS decisions, and plan components limit the treatment methods for some invasive plants in riparian areas and near groundwater dependent ecosystems; for example, buffers, hand pulling or glove wicking may be required instead of herbicide use.

All the revised plan alternatives have desired conditions of non-existent or low abundance invasive species, including aquatic invasive species, which do not disrupt ecological functioning. Management approaches for aquatic invasive species address educational efforts and disinfection measures for both publics and agency personnel for prevention measures.

Effects from Wildlife Management

Invasive plant expansion is most likely occurring to some degree with transport of seed from wildlife. Several satellite patches of noxious weeds are located on the Custer Gallatin National Forest that are far from roads and trails, have no possible livestock or pack animal access, and are far from any known infestation. Native ungulates can move seeds from infested areas and relocate them in remote or off-the-grid areas. Hounds tongue has been and will continue to be on the move throughout the Custer Gallatin, but other species such as spotted knapweed and toadflax species are showing up in unexplainable places. Birds could be another transporter of weed seed. These transport issues from wildlife will continue under all alternatives.

Under all revised plan alternatives, permitted grazing of domestic sheep would be precluded inside the recovery zone/primary conservation area for grizzly bears, except for the targeted use of domestic sheep or goats for the express purpose of weed control. The grizzly bear recovery zone/primary conservation area is in the Absaroka Beartooth Mountains and the Madison, Henrys Lake, Gallatin Mountains Geographic Areas, but does not cover the entirety of the Geographic Areas.

The current plans, along with alternatives B, C, and E allow for sheep or goats for weed control forestwide with appropriate risk assessment relative to risk of disease transmission with bighorn sheep while alternative D does not allow for sheep or goats for weed control forestwide. Under alternative D biological control by sheep or goats is removed as a treatment method in the Sioux; Ashland; and Bridger, Bangtails, Crazy Mountains Geographic Areas where bighorn sheep do not occur and where risk of contact is extremely low. Under alternative D biological control by sheep or goats is removed as a treatment method in the remaining geographic areas and forecloses opportunities to conduct site-specific risk of contact assessments for targeted and tightly controlled grazing for weed control. Use of domestic livestock grazing for targeted weed control lends itself well to tight restrictions on timing, number of animals, location of use, and oversight requirements, so risk of contact with bighorn sheep could be effectively minimized.

All revised plan alternatives have desired conditions of having invasive species, including white-nose syndrome fungus, be non-existent or in low abundance, and do not disrupt ecological functioning. Management approaches for white-nose syndrome address educational efforts and disinfection measures for both publics and agency personnel for prevention measures.

Effects of Land Allocations for Designated Wilderness

Generally, wilderness areas and large roadless lands are less likely to contain invasive weeds due to less widespread public access, especially via motorized means. However, these large roadless areas are vulnerable to weed infestation and spread from recreational uses. Seed transport happens inadvertently, by humans, dogs, and pack stock. Trails that receive high uses, including those in wilderness areas, are vulnerable to invasive weed infestation. Areas of high use and ground disturbance occur within wilderness areas and are as vulnerable to weed infestation as developed sites outside wilderness and are more difficult to treat due to limited access. Designated wilderness plan components in all alternatives that limit group size and close certain areas to camping and stock use may help reduce potential for invasive weed infestation.

Effects from Access and Recreation Management

A main vector for seed spread is vehicle use (Taylor et al. 2012). Many existing infestations can be found along, or have originated from, roadsides because vehicle traffic provides ideal means for noxious weed spread. Primitive two-track roads also provide opportunity for noxious weeds to become established on areas of bare soil and disturbance. Once invasive species establish on road or trailside prism, the threat of spreading into adjacent native plant communities has a high likelihood if vigilant monitoring and treatments do not occur. An even greater threat for spread of invasive species is from unauthorized cross-country travel. Infestations can go undetected for years, resulting in a well-established population that oftentimes are difficult to access.

Transportation of weed seed by contractor or special use vehicles, or equipment, on National Forest System roads is managed to a degree. Contract stipulations are used to require specific actions, such as, vehicle and equipment washing, to lessen the possibility of weed transport to reduce the risk of new infestations. Recreational use of roads and motorized trails as well as unauthorized cross-country travel by the general public presents a greater risk, because of the lack of control measures and the lack of knowledge about invasive species spread.

In all alternatives, inadvertent seed spread could decrease in areas that either are closed to motorized access or are more difficult to access. During road closure and decommissioning activities that require short-term ground disturbance, there could be short-term invasive plant establishment until invasive weed treatments are applied to the disturbed area. Additionally, road closures and/or decommissioning make administrative access more difficult to treat invasive species in some areas of the Custer Gallatin National Forest.

Road obliteration projects for travel management purposes also can create ideal conditions for invasive species to establish. Road obliteration would occur under all alternatives. There are about 40 miles of road that are closed to public use but not yet removed from the road system. All alternatives propose to remove all 40 miles of road.

Alternatives vary in the amount of motorized access opportunities for recreational and administrative use, both on roads and trails. Summer motorized uses pose the greatest risk of invasive weed transport.

In general, the potential for weed infestation threats would be heavily correlated to the amount of open motorized routes and area of summer motorized travel and correlated to recreation opportunity setting classification by alternative (table 54).

There are no changes to open motorized road and trail routes in alternatives A, B, and E. Under alternative C, about four miles of trails would no longer be available for motorized recreation use. Under alternative D, about 172 miles of trails would no longer be available for motorized recreation use.

There are no changes to open non-motorized routes in the current plans, and alternatives B and E. Since motorized trails are also open to bicycle use, the trails discussed above that are not available for motorized use are also not available for bicycle use. In alternatives C and D, non-motorized trails would no longer be available for bicycle use. Under alternative C, about 20 miles of trails would no longer be available for bicycle use. Under alternative D, about 256 miles of trails would no longer be available for bicycle use.

Table 54. Miles of open and administrative roads, trails and percent of roaded recreation opportunity spectrum settings pertaining to summer use

Attribute	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Miles of open roads and motorized administrative routes	2,887	2,887	2,887	2,887	2,887
Miles of summer trail available to motorized recreation	1,121	1,121	1,117	949	1,121
Miles of summer trail available to non-motorized uses (hiking, riding, bicycle); miles vary by trails open to bicycle use	1,922	1,922	1,902	1,666	1,922
Summer recreation opportunity spectrum acres classified as motorized (rural, roaded natural and semi-primitive motorized) and percent of forest	1,293,716 (43 percent)	1,287,493 (42 percent)	1,250,350 (41 percent)	1,156,490 (38 percent)	1,304,978 (43 percent)

Alternative A represents the current plans' future projections if kept

Alternative D would be the most favorable to limit the spread of invasive species from motorized and non-motorized use because it would have the least amount of trails that would be available to motorized and bicycle use and acreage identified in motorized Recreation Opportunity Settings classes. The current plans and alternatives B and E would be similar for having a higher potential to increase the spread of invasive species through motorized and non-motorized transportation since the alternatives would have the most miles of trails available to motorized and bicycle use and fewer acres of summer primitive or semi-primitive settings. Alternative C would have fewer miles of trails available to motorized and bicycle use than the current plans and alternatives B and E.

Although alternative D would be the most favorable for slowing the spread of invasive species by motorized means, the alternative could also create issues for existing weed infestations to go undetected and untreated in new recommended wilderness areas. Alternative D would change the most miles of trails available to motorized and bicycle use and possible weed vectors of any alternative, but could also increase treatment difficulty or detection of existing weed populations in recommended wilderness. As long as resources continued to be devoted to monitoring and treatment of weeds on routes no longer available to motorized use, minimal negative effects would result from all revised plan alternatives, which would result in fewer trails available to motorized and bicycle use.

Road maintenance, reconstruction and construction can contribute to the establishment and spread of invasive plants. Gravel pits can oftentimes become infested with weeds if not routinely checked and treated. Weed seeds can be spread onto lands far from the gravel pit when gravel is used for road surfacing or other purposes. This potential for this effect would be the same under all alternatives; however plan components and policy are in place to mitigate this. Management direction to address invasive plant species is in place for all alternatives and would continue to be followed (Forestwide Weed Management EIS decisions, 2005 and 2006).

Recreational activities, including non-motorized, are vectors for potential seed establishment and dispersal. Recreation activities and areas receive concentrated and frequent use and continual ground disturbance. Frequently, infestations are found around trailheads, trails, campgrounds, and other developed recreation sites. These seed sources pose a risk of further spread into wilderness and undeveloped lands. Areas located immediately adjacent to and surrounding developments tend to experience the most disturbance, while the peripheries of these areas are less disturbed and less likely to be favorable for invasive species establishment and persistence.

The revised plan alternatives include a goal for public education. Methods used to help prevent invasive species from being introduced and spreading into recreation areas include public education and requirements for use of weed-free hay for pack stock. Public education efforts, such as the Play Clean Go campaign, have helped raise invasive species awareness for many recreational activities. Lack of public knowledge, combined with limited enforcement and/or monitoring options for recreational activities is a concern for weed introductions, and would be similar for all alternatives.

Effects from Permitted Livestock Grazing Management

Invasive species expansion may occur with the transport of seed by livestock from infested areas. Seeds can be spread through livestock feces, fleeces, and hooves, and many can pass through an animal’s digestive system and retain the ability to germinate (Belsky and Gelbard 2000). Native grazers such as mule deer, bighorn sheep and elk, and some birds can also perform this same method of seed spread. Conversely, prescribed livestock grazing has also been shown to be an effective method in managing some large invasive plant infestations while assisting the ecological succession process (Sheley et al. 2011).

Localized areas where congregation can occur, such as water developments and supplement locations, contribute to reduced ground cover and can become potentially susceptible to invasive plant establishment. All alternatives would have equal impacts from livestock grazing relating to invasive species establishment on acres where disturbance results in reduced native plant vigor and cover. The revised plan alternatives include plan components that would enhance rangeland vegetation communities, which would be more resistant to invasive species. Options to adjust livestock grazing management in the future may involve more range improvement infrastructure, thus increasing acres disturbed by construction activities in the short run. Some initial ground disturbance from new off-site water development and fencing may cause some ground disturbance, and therefore, provide a niche for invasive plants to establish. Typically, supplemental feeding with hay on National Forest System lands is not permitted which reduces opportunity for a potential invasive species spread vector. In the long term, the revised plan alternatives would improve livestock grazing management, which in turn promotes the enhancement of desirable native plant communities. The revised plan alternatives provide plan components to increase the resistance and resilience of native plant communities and pursue the best available invasive species management options while maintaining multiple uses like livestock grazing.

Effects from Energy and Minerals Management

All energy and mineral management activities on national forest lands are required to meet applicable environmental protection measures as required by law, regulation, and policy. Proposed energy and mineral activities are subject to review and approval, as well as environmental analysis, review, application of best management practices, including those for invasive species, reclamation and monitoring. Plan components direct that energy and mineral activities only be authorized when the associated reclamation plan includes provisions to return disturbed areas to stability and land use comparable to adjacent lands and/or pre-operational site conditions, which would include weed monitoring and treatments.

Cumulative Effects

Invasive species spread without regard to administrative boundaries. As such, the cumulative effects of the Custer Gallatin National Forest invasive species management under any alternative, including the current plans, may negatively or beneficially impact adjacent Federal, state and private lands depending upon the specific site treatment or lack thereof. Adjacent or nearby landowners specific site conditions and weed treatment efforts also would affect weed conditions and treatments on National Forest System lands. Many acres of individual and other private entity lands lie within the boundaries the Forest, and adjacent to National Forest System lands. Under all of the alternatives, coordination with state and local agencies and communication with the public would continue to combat the spread of undesirable non-native invasive species.

Portions of the Custer Gallatin National Forest adjoin other National Forests, each having its own forest plan. The Custer Gallatin National Forest is also intermixed with lands of other ownerships, including private lands, other Federal lands, and state lands. Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans in conjunction with the Custer Gallatin National Forest revised forest plan cumulatively affect to invasive species management.

The forest plans for national forest system lands adjacent to the Custer Gallatin National Forest include the Helena Lewis and Clark, Shoshone, Caribou-Targhee, and Beaverhead-Deerlodge National Forests. All plans address invasive species. In general, management of invasive species is consistent across all national forests due to law, regulation, and policy and plan components are relatively consistent and compatible with overall goals.

Bureau of Land Management lands near the Custer Gallatin are managed by the Dillon (2006 plan), Butte (2009 plan), Billings (2015 plan), Miles City (2015 plan) and South Dakota (2015 plan) field offices. The resource management plans are the BLM equivalent to a forest plan and would manage for healthy native plant communities and aquatic systems by addressing invasive species.

The Greater Yellowstone Area Coordinating Committee Terrestrial Invasive Species subcommittee includes Forest representatives. This committee coordinates annually on various invasive plant species topics such as overall coordination, coordinated weed management areas, Greater Yellowstone Area weed database; gravel pit maintenance and monitoring, and new invaders. Plan components are consistent and compatible with overall goals of this subcommittee.

The Yellowstone National Park 2014 Foundation Document calls for preserving environmental integrity, which allows natural processes to shape ecosystem functions. Broadly, the terrestrial and aquatic resources characteristics in this area and guidance toward invasive species are therefore likely similar to the wilderness areas in the adjacent Absaroka-Beartooth and Madison, Henrys Lake, Gallatin geographic areas and would likely complement these conditions.

The NRCS Soil Health strategy (U.S. Department of Agriculture 2015b) briefly outlines goals related to promoting soil health and conservation, primarily on agricultural lands. Soil quality is expected to be good; however, these areas may still support invasive species on agricultural lands.

Montana conducted a statewide assessment of forest resources and identified issue-based focus areas with implementation strategies including Forest Biodiversity and Resiliency (Statewide Forest Resource Strategy, 2017). Strategies include managing ecosystem and biotic composition to achieve ecological integrity through recovery of species diversity, water quality and quantity, soil quality and function by implementing best available science and adaptive management; and increasing terrestrial carbon sequestration and soil carbon sinks. The maintenance of native vegetation and emphasis on diversity is expected to contain or reduce invasive species. This management is expected to be complementary.

Noxious weed treatment routinely occurs in each county in and near the Forest. County plans generally aim to maintain native vegetation communities and reduce noxious weeds.

Conclusion

Invasive plants will continue to have a presence on the Custer Gallatin National Forest landscape, with existing infestations and continual introductions of new invaders. Some invasive species have become “naturalized” to vegetation communities on the Custer Gallatin National Forest, and some level of their presence will persist in all alternatives. Management under all alternatives would attempt to slow the spread of weeds and introductions of new invaders. However, in comparison to the other alternatives, Alternative E would do less to slow the spread since objectives for weed treatment are about one quarter of recent annual levels of treatment that have been done. All alternatives provide prevention measures to keep weed species from establishing into new non-infested areas. The Custer Gallatin National Forest will continue to conduct weed treatments with the most effective options (chemical, mechanical, and biological) as they become available and to implement mitigations such as the weed-free forage program, use of weed free sites during fire and other incidents and vehicle washing/inspections for contracts.

The revised plan alternatives update the 1986 and 1987 forest plans for management of nonnative invasive plants by formalizing current, effective invasive species management practices. Plan components in the revised plan alternatives would have a positive effect to slow the spread of invasive plants as well as manage existing infestations by moving towards adopting best tools and practices available in the future.

Alternatives A, B, and C have potential to create similar amounts of disturbance relating to timber harvest and prescribed fire with alternative D having potential to create the most amount of disturbance by vegetation management activities. Alternative E may be the most favorable as far as limiting the total harvest and prescribed fire footprint on the Custer Gallatin. Vegetation management projects would have plan components that prescribe best management practices that should limit the introduction of invasive species as well as implement treatment options if they are found.

Plan components under all alternatives regarding livestock grazing should generally have positive effects on rangeland vegetation condition. In turn, rangelands within grazing allotments should have more resilient and resistant plant communities that can compete with invasive species to a certain degree. Small, localized areas of disturbance relating to range improvement construction may be vulnerable to weed infestation and will need monitoring and treatment actions built into project design. However, these improvements should help improve vegetation condition and grazing management that will benefit rangeland vegetation in the future.

Alternative D, with more recommended wilderness areas, would have fewest spread vectors by vehicles since it would have 172 fewer miles available to motorized recreation use than the next lowest alternative C, which would have about 4 fewer miles. The current plans and alternatives B and E would have no change. All alternatives have options to implement best management practices and treat weeds on open motorized and bicycle routes.

All alternatives except D allow for sheep or goats for weed control forestwide with appropriate risk assessment relative to risk of disease transmission with bighorn sheep while alternative D does not allow for sheep or goats for weed control forestwide. Under Alternative D biological control by sheep or goats is removed as a treatment method in the Sioux, Ashland, and Bridger/Bangtails/Crazy Mountains geographic areas where bighorn sheep do not occur and where risk of contact is extremely low. Under Alternative D biological control by sheep or goats is removed as a treatment method in the remaining geographic areas and forecloses opportunities to conduct site-specific risk of contact assessments for targeted and tightly controlled grazing for weed control. Use of domestic livestock grazing for targeted weed control lends itself well to tight restrictions on timing, number of animals, location of use, and oversight requirements, so risk of contact with bighorn sheep could be effectively minimized.

Ultimately, consequences to invasive plants from forest plan components associated with balance of funding with other resource programs or revision topics are similar under the current plans and alternatives B and C, while alternative D places more emphasis on weed treatment and alternative E provides less emphasis on treatment in plan objectives. Management activities mitigate risk, but lower treatment objectives under alternative E has the greatest risk of spread due to less treatment of spread vectors. An aggressive integrated pest management approach must be implemented in order to keep invasive species from expanding beyond existing infestation levels.

All revised plan alternatives provide sufficient plan components and prevention management approaches and best management practices for aquatic invasive species, emerald ash borer, white pine blister rust and white-nose syndrome.

3.10 Wildlife Diversity

3.10.1 Introduction

The following sections address consequences to wildlife and their habitat from the range of alternatives considered. This analysis deals primarily with terrestrial wildlife species, including land-dwelling birds, mammals, reptiles, and invertebrates. Aquatic and semi-aquatic species, including fish, amphibians, beavers, and aquatic invertebrates, are addressed in the Watershed, Aquatic, and Riparian sections of this document.

The 2012 Planning Rule requires the forest plan to provide the ecological conditions to maintain the diversity of plant and animal communities and support the persistence of native species over time. The Custer Gallatin National Forest provides a complex, and widely variable range of habitats, which in turn supports a high diversity of wildlife species. According to the Montana Natural Heritage Program website (http://mtnhp.org), as of June 2018, over 360 different species of mammals, birds and reptiles have been recorded within the national forest boundary. Adding all invertebrate species nearly doubles that number (ibid.). Some of these species are migratory, and may spend only a season here, or may just pass through during travels between seasonal ranges elsewhere, while others may spend their entire lives within the national forest boundary. Many of the terrestrial wildlife species on the Custer Gallatin National Forest are habitat generalists, and as a result, are common and widespread across the entire national forest. However, because of the vast ecological differences between the higher elevation, mountainous west-side (referred to as the Montane Ecosystem) and the lower elevation, gentler terrain on the east side (referred to as the Pine Savanna Ecosystem), some species are found only in parts of the Custer Gallatin National Forest.

A number of "keystone" species on the Custer Gallatin National Forest can, and often do, have a major effect on plant and animal distribution and habitat diversity. The Custer Gallatin hosts a variety of predators, ranging in size from bears to weasels, eagles to kestrels, and rattlesnakes to garter snakes. Predators can influence population levels and distribution of big game species as well as small mammals, birds, reptiles, and insects. Ecological engineers are also present within the national forest. Herbivores, such as large ungulates (including native species as well as domestic livestock), can influence vegetation structure, composition and distribution. Insects can have a notable effect on habitat conditions, including reductions in live tree canopy and associated cover, as well as increased availability and distribution of snags and down woody debris. At the same time, many bird and bat species are insectivorous, and help keep insect populations in check. People can also have a notable effect on wildlife habitat and associated species abundance and distribution.

The remarkable habitat diversity of the Custer Gallatin National Forest is a function of topography, hydrography soils, climate and disturbance processes. These factors create the vegetation and structural conditions that provide food, water, and shelter for wildlife. In general, areas of high habitat diversity not only provide for greater wildlife species diversity, but also tend to be more resilient to stressors such as fire, floods, insects, disease, drought, and climate change. Habitat diversity facilitates wildlife movement between different conditions necessary to support various life cycle stages, while habitat conditions, such as fragmentation and connectivity also influence the flow of animals and genetics across landscapes.

The Custer Gallatin National Forest contains habitat for a number of species either previously, or currently, federally recognized under the Endangered Species Act as threatened, endangered, proposed, or candidate species. In addition, the Regional Forester has identified species of conservation concern, which include species other than federally recognized species, known to occur in the plan area, and for which the Regional Forester has determined that the best available scientific information indicates substantial concern about the species' capability to persist over the long term in the plan area.[9] Collectively, these are referred to as "at-risk species."

[9] See 36 CFR 219.9(c)

The status of at-risk species can change over time. For example, at-risk species may be removed from Federal lists as populations recover, or if new information indicates a species is more abundant, widely distributed, or more persistent than previously thought. Species' status may change from one category to another, such as when a species proposed for listing is found warranted, and officially becomes federally listed as threatened or endangered. Finally, new species may be added to lists of at-risk species by the U. S. Fish and Wildlife Service or the Regional Forester at any time based on new information about population trends, habitat conditions, and known threats. Because the status of at-risk species is subject to change, plan components neither rely upon the particular status of a species nor change automatically with a species' change in status. Plan components remain in effect unless and until an amendment removes or updates them. Current lists of species federally recognized under the Endangered Species Act that may be present on the Custer Gallatin National Forest are maintained by the U. S. Fish and Wildlife Service Field Offices in Montana and South Dakota. The current list of species of conservation concern for the Custer Gallatin National Forest and the process used to identify these species are maintained at the Forest Service Northern Region Headquarters, and can be viewed on the Region's website.[10]

Wildlife and habitat on the Custer Gallatin National Forest have a great many social, economic, recreational, spiritual, and scientific benefits to people. Hunting and trapping of wildlife are a long-standing tradition in western culture and present a major economic driver in western states, including both Montana and South Dakota. Viewing and photography of wildlife are popular recreation activities, as well as careers that support local, national, and international economies. In addition to recreational pursuits, there are many wildlife-related jobs in communities associated with the Custer Gallatin National Forest, including both technical and professional careers for biologists, managers, researchers and advocates, as well as wildlife-related vocations in the recreation industry, such as outfitters, guides, taxidermists, writers, artists, photographers and filmmakers. Because of the incredible wildlife diversity, and presence of rare species in this area, the wildlife resource here is locally, nationally, and internationally recognized and cherished.

Regulatory Framework

A number of statutory authorities affect wildlife and habitat management on National Forest System lands. These laws work in concert with other laws, regulations, and policy described elsewhere in this document, to support ecological conditions and processes, while also providing societal goods and services. Following are a list of key laws and regulations pertaining to wildlife and habitat management on the Custer Gallatin National Forest.

Migratory Bird Treaty Act of 1918: Prohibits unauthorized take of migratory birds, as defined through subsequent regulations. Executive Order 13186 (66 FR 3853) outlines the responsibilities of Federal agencies to protect migratory birds in furtherance of the Migratory Bird Treaty Act.

Bald and Golden Eagle Protection Act of 1940: Prohibits unauthorized take of bald and golden eagles, as defined through subsequent regulations.

Endangered Species Act of 1973, as amended: Provides requirements for Federal agencies with regard to species listed as threatened or endangered, proposed for listing, or candidates for consideration under the act. Section 2 requires all Federal agencies to "seek to conserve endangered species and

[10] www.fs.usda.gov/goto/R1/SCC.

threatened species," and section 7 requires Federal agencies to ensure that the actions authorized, funded, or carried out by them are not likely to jeopardize the continued existence of any threatened or endangered species or result in the destruction or adverse modification of their critical habitats.

Sikes Act of 1974, as amended: Directs the Secretaries of Interior and Agriculture to cooperate with the States in developing comprehensive plans to maintain, and coordinate the conservation and rehabilitation of, wildlife, fish, and game, including but not limited to protection of species considered threatened or endangered pursuant to section 4 of the Endangered Species Act, or considered to be threatened, rare, or endangered by the State agency.

National Forest Management Act of 1976, as amended: States that the Secretary (of Agriculture) shall promulgate regulations, under the principles of the Multiple-Use Sustained-Yield Act of 1960, to provide for diversity of plant and animal communities based on the suitability and capability of the specific land area in order to meet overall multiple-use objectives. The 2012 Planning Rule is based upon, and determined to be consistent with, this act (77 FR 21162).

Native American Treaties: Custer Gallatin National Forest lands are governed by eight separate treaties that reserve hunting and other rights for Native American Tribes. See the Areas of Tribal Importance section of this document for more details on these treaties**.**

2012 Planning Rule: Relative to wildlife species and habitats, this rule directs national forest planners[11] to consider:

1. habitat conditions for at-risk species,
2. habitat conditions for wildlife commonly enjoyed and used by the public for hunting, trapping, gathering, observing, subsistence and other activities in collaboration with federally recognized Tribes, other Federal agencies, State and local governments;
3. dominant ecological processes, disturbance regimes, and stressors such as natural succession, wildland fire, invasive species, and climate change;
4. the ability of the terrestrial and aquatic ecosystems in the plan area to adapt to change;
5. habitat connectivity; and
6. riparian areas.

If the responsible official finds that it is beyond the authority of the Forest Service or not within the inherent capability of the plan area to maintain or restore the ecological conditions to maintain a viable population of a species of conservation concern in the plan area, then the responsible official must show that the plan includes plan components, including standards or guidelines, to maintain or restore ecological conditions within the plan area to contribute to maintaining a viable population of the species within its range. The Planning Rule defines viable population as "a population of a species that continues to persist over the long term with sufficient distribution to be resilient and adaptable to stressors and likely future environments.[12]

[11] See 36 CFR 219.10(a)(5); 219.8; and 219.9(b)(1)
[12] See 36 CFR 219.19

Key Indicators and Measures

Key ecosystem characteristics were identified as indicators of ecological integrity of biological resources in term of composition, structure, function and connectivity. Some of these components are addressed in detail in other sections of this document including Watershed, Aquatic, and Riparian Ecosystems and the Terrestrial Vegetation sections. Since wildlife habitat is largely dependent upon hydrologic and vegetative conditions, the wildlife and habitat analyses presented here often tiers to key indicators and measures found in the aforementioned sections. Other key indicators and measures of wildlife habitat quality vary by wildlife species and unique habitat types, and are therefore addressed in those sections that follow. Unless noted otherwise for a particular species or habitat, key indicators for indirect and cumulative effects include quantitative measures where available of anticipated changes to species habitats, as well as qualitative descriptions of plan component contributions to, or potential to address, key stressors for species and their habitats.

Methodology and Analysis Process

In developing plan components, alternatives, and the associated effects analyses, we considered information on local wildlife populations and habitat factors, including presence, abundance, distribution, population trends, habitat condition trends, known stressors, and responses to management actions. This process involved:

- compilation of species-specific observation and use data
- identification and assessment of key ecosystem characteristics and trends
- assessment of known or potential system drivers and stressors and their influence on key ecosystem characteristics and wildlife populations
- an assessment of existing wildlife habitat conditions relative to the natural range of variation;
- an assessment of projected changes in wildlife populations and habitat that could result from implementation of the range of planning alternatives identified
- an assessment of projected changes in wildlife populations or habitat that could result from cumulative effects of management actions and land uses that could occur under other land management plans

Wildlife analyses relied on quantitative and spatial outputs from a number of modeling exercises, using Geographic Information Systems, and other tools. Such models were used to evaluate:

- motorized route densities and the amount and distribution of secure habitat for grizzly bears and other species;
- proportions of unique habitat types affected by permanent human developments such as roads and other infrastructure (GIS queries);
- amounts and types of habitat for species such as lynx, wolverine, sage-grouse and bison;
- important areas for wildlife habitat connectivity; and
- predicted changes in climate patterns and potential impacts to wildlife and habitat.

Similar models were used to evaluate existing conditions, and predict environmental consequences in the aquatic and riparian ecosystems, terrestrial vegetation, and fire and fuels. These assessments often provided the basis for some wildlife habitat evaluations. Analysis methods, processes and models used for these assessments are found in separate sections of this document.

Effects analyses, including some of the modeling efforts, are based on a number of assumptions, including the following:

- The forest plan provides a programmatic framework that guides site-specific actions, but does not mandate, authorize, fund, or carry out any particular project or activity. Before any ground-disturbing activities may take place, they must first be authorized in a site-specific decision document with supporting environmental analysis. Therefore, the plan itself neither results in direct effects to wildlife or habitat, nor causes any unavoidable adverse impacts or irreversible and irretrievable commitments of resources. However, the forest plan may result in indirect and cumulative effects to wildlife and habitat, as future projects are implemented and management actions occur in a manner consistent with the programmatic framework provided in the plan.
- All applicable laws, regulations, and policy will be followed when planning or implementing new site-specific projects and activities under the guidance of the forest plan.
- Desired conditions listed in the forest plan will determine how projects are designed and resources are allocated over the life of the plan. The Custer Gallatin National Forest staff will strive to meet goals and objectives stated in the plan. Suitability allocations, standards, and guidelines will be followed when planning and implementing new site-specific projects and activities.
- There is some degree of uncertainty with all modeling efforts, but the models used in the effects analysis provide a reasonable approximation of past, current, and predicted future environmental conditions upon which to base assessments and form conclusions.
- Data collected at the national forest, regional and national scale have varying levels of accuracy, but provide a reasonable representation of wildlife occurrence, abundance, distribution, and habitat conditions on the Custer Gallatin National Forest.
- The natural range of variation reflects ecosystem conditions that have sustained the current complement of wildlife and habitats on the Custer Gallatin National Forest, and provides the context for understanding the natural diversity of ecosystems and processes, such as wildfire, insects and disease, and natural plant succession.
- Population trends of wildlife species may change as a result of effects from national forest management practices. However, due to the natural range of vegetation patterns and disturbance processes in the northern Rocky Mountains and Great Plains, fluctuations in wildlife populations and distribution are normal, and often result from natural factors such as predation, starvation, disease, or wide-scale habitat changes resulting from fire, flood, drought, and other natural disturbance processes. For migratory species, a change in population may not reflect a change in local habitat conditions, but rather occur as a result of activities or conditions experienced elsewhere in the United States or even in other countries.
- Global and State species rankings are accurate indices of species status at the relative scale, but may or may not be indicative of local wildlife populations in the Custer Gallatin National Forest.

Finally, wildlife habitat occurs as a function of the biophysical composition of the landscape. Habitat for wildlife is a product of the vegetation, water, soils, topography, and associated ecological processes (including both natural and human-induced changes) from the micro-site level to local, regional and even global extents. To this end, the wildlife analyses rely on, and often tier to, information and analysis presented in other sections of this document.

Information Sources

This analysis contains an extensive review of, and reference to, the best scientific information available for purposes of documenting the status, habitat relationships, potential threats, and response to management activities of terrestrial wildlife species known to occur within the Custer Gallatin National Forest. Literature sources that were the most recent; peer-reviewed; and local in scope or directly applicable to the local ecosystem were selected. Articles found to be the most relevant were those based upon local studies; such as those conducted in southwestern, southcentral, or southeastern Montana, or northwestern South Dakota. Literature from further regions, but with habitats or ecological conditions similar to those found in the plan area, were also found to be pertinent. Uncertainty and conflicting conclusions found in literature are acknowledged and interpreted when applicable. In addition, key information on population trends, life history, and status of terrestrial wildlife species in the plan area was obtained from the Montana Field Guide (http://fieldguide.mt.gov), state wildlife management agencies for Montana and South Dakota, Natural Heritage Programs, Nature Serve, the U.S. Fish and Wildlife Service, and the Interagency Grizzly Bear Study Team. Finally, local data collected by Forest Service personnel, contractors, and agency partners informed analyses with respect to species occurrence, abundance, distribution, as well as local habitat conditions and trends.

Habitat modeling efforts specific to the Custer Gallatin National Forest were used in the analysis, as described above in the methods section. Details about these local models and the data used in them, is contained in species- or habitat-specific sections below. In addition to Custer Gallatin-specific models, a number of external modeling efforts were consulted for relevant information. Given the importance of habitat connectivity for maintaining species persistence and associated biological diversity, a great deal of attention has been devoted to identifying potential movement corridors for many different species in recent years, particularly in the Greater Yellowstone Area. Such models provide concepts that are useful for identifying high priority areas for protection and restoration in order to sustain functional connectivity across the landscape. However, most of the research and resulting wildlife movement modeling efforts have had a single species focus, whereas this forest planning requirement is to provide habitat connectivity for native species. Further, while methods for validating connectivity models against empirical data exist, they have not been standardized (McClure et al. 2016). On the other hand, without any validation, the reliability of a model is basically unknown.

Downscaled climate models are used to predict the effects of a changing climate for a number of resources. For planning and analysis purposes, we used a compilation of climate change effects published for the Northern Region Adaptation Partnership (Halofsky et al. 2018a and b) that summarizes climate change projections by sub regions. As part of that effort, McKelvey and Buotte (in Halofsky et al. 2018b) provide a summary of modeled climate change impacts on wildlife in the northern Rocky Mountains.

Wild animals are mobile, wary, and often actively avoid humans. Therefore, it can be difficult to locate and study individuals, let alone obtain meaningful scientific information for entire populations. Population trend information is extremely difficult to obtain, because it requires data for at least a reasonable reference set of individuals, including information on survival and reproduction rates, as well as immigration and dispersal. Considering the large number of wildlife species inhabiting the vast expanse of the Custer Gallatin National Forest for at least part of their life cycle, there is limited scientific information on biology, ecology, and population trends for the majority of species present that is specific to the plan area. Some species are more rare or associated with remote, rugged environments, or are present here for a relatively short time before moving elsewhere, making detection and observation even more difficult.

Habitat, on the other hand, is generally stationary, and can be readily surveyed, monitored, and studied over time. However, the large geographic extent and wide range of habitat diversity within the Custer Gallatin National Forest generates considerable complexity for research and monitoring purposes. Demonstrating causality and relationships between the myriad of factors affecting wildlife habitat is not only difficult, but also costly. As a result, uncertainty exists regarding the direct, indirect, and cumulative impacts of various collective management activities on individual animals, habitat, and wildlife populations. Further, the science surrounding climate change is still relatively new and somewhat limited. While there is an appreciable body of science on the topic, and information is growing at a considerable rate, there is still much ambiguity and scientific disagreement on not only the potential impacts to habitat, but also how such impacts might affect wildlife populations.

Analysis Area

The analysis area used to examine indirect effects of plan components for most wildlife species and their habitats includes the National Forest System lands within the Custer Gallatin National Forest boundary. The cumulative effects analysis area for most species is the same as that used for indirect effects, but may expand beyond the national forest boundary for large ranging species such as the grizzly bear, as well as for larger landscape concepts such as habitat connectivity. On the other hand, some species' ranges are quite limited on the Custer Gallatin, for example the greater sage-grouse and white-tailed prairie dog. For these species, the spatial scale used for analysis is limited to the geographic areas in which the species is either known to occur, or where habitat is present. Unless noted otherwise in species-specific sections below, the spatial scale for indirect and cumulative effects is the area within the Custer Gallatin National Forest boundary.

The temporal scope of the analysis is the anticipated life of the plan, with longer-term consideration (up to 50 years) for consequences resulting from implementation of the plan. This timeframe is consistent with the analysis period for key ecosystem characteristics associated with the terrestrial vegetation.

3.10.2 Federally Listed Wildlife Species

This section addresses effects of plan alternatives on wildlife species federally protected under the Endangered Species Act. This includes those currently listed as threatened or endangered, as well as species proposed by the U. S. Fish and Wildlife Service to be listed under the Endangered Species Act. Candidate species are those species for which the U. S Fish and Wildlife Service possess sufficient information on vulnerability and threats to support a proposal to list, but for which no proposed rule has yet been published. At the time this analysis was prepared, there were no terrestrial wildlife species known to occur on the Custer Gallatin National Forest that were candidates for Federal listing. The U.S. Fish and Wildlife Service maintains the lists of federally protected species. Current lists for species that may be present on the Custer Gallatin National Forest are maintained by the Montana and South Dakota Field Offices of the U.S. Fish and Wildlife Service. The Montana Field Office maintains species lists specific to the national forest boundaries, whereas the South Dakota Field Office lists species by county. The entire portion of the Custer Gallatin in South Dakota is located in Harding County. Current lists can be viewed at the websites for Montana and South Dakota field offices of the U.S. Fish and Wildlife Service.[13]

Species Not Currently Known to Occur on the Custer Gallatin National Forest

There are a number of species on U.S. Fish and Wildlife Service lists that "may be present" in parts of the Custer Gallatin National Forest, but for which there are no recent, or verified observations or occurrences on record within the national forest boundary at the time this analysis was prepared. This includes all species listed as endangered that the U.S. Fish and Wildlife Service has indicated may be present within the Custer Gallatin National Forest. Since these species are not known to occur here, or have been absent for several decades, they were not analyzed in detail. However, since these species may be present at some point, they are addressed briefly here. Federally listed species that may be present, but are not known to occur on Custer Gallatin include the least tern (*Sternula antillarum*), whooping crane (*Grus Americana*) and red knot (*Calidris canutus rufa*). There are no documented occurrences of these species on the Custer Gallatin National Forest (http://mtnhp.org, Deisch, S. South Dakota GFP 2018a. pers. comm.).

Analysis Area

The least tern, whooping crane and red knot are all associated with the pine savanna ecosystem found in the eastern part of the Custer Gallatin National Forest. Their known and predicted migratory flyways overlap parts or all of the Ashland and Sioux Geographic Areas. Therefore, the analysis area for this section includes these geographic areas as well as other land ownerships between the administrative units contained within them.

Affected Environment (Existing Conditions)

These species were all historically associated with the pine savanna ecosystem found in the eastern part of the Custer Gallatin. The least tern, whooping crane and red knot are all migratory bird species. Least terns nest in the sparsely vegetated sand bars and gravel shores of the Yellowstone and Missouri Rivers (Marks et al. 2016) north and east of the Ashland and Sioux Geographic Areas. Little is known about wintering habitats of least terns, as they join with flocks of other tern species and are indistinguishable. Fall migrants are thought to follow major river drainages to the Gulf of Mexico; however, late season sightings of least terns dozens of miles from major river basins suggests that at least some individuals travel cross-country (USDI FWS 2013a), where they may use stopover habitat on the Custer Gallatin National Forest. Whooping cranes breed in Canada and winter in southern Texas, while the red knot breeds in the arctic, and winters in coastal South America (NatureServe http://explorer.natureserve.org). While the Custer Gallatin National Forest provides neither summer breeding habitat nor wintering areas for any of these species, it may provide migratory stopover habitat. However, there have been no documented occurrences of any of these species on the Custer Gallatin (Deisch, S. South Dakota GFP 2018a. pers. comm.).

Key Stressors

The key stressor for these species is loss of habitat. Least tern habitat has been decimated by water management projects such as channelization and impoundments, and natural river flow regimes were altered with construction of Fort Peck dam. Flooding of breeding habitat due to high water flow is listed

[13] https://www.fws.gov/montanafieldoffice/Endangered_Species/Listed_Species/Forests/CusterGallatin_sp_list.pdf
https://www.fws.gov/mountain-prairie/es/southdakota/species.php

as the current primary threat to least terns in Montana. Whooping crane population declines are largely attributed to loss of wetland habitats with European settlement. DDT, an insecticide widely used mid-20th century also affected whooping crane populations. More recent threats to whooping cranes include collisions with powerlines and wind turbine blades. Red knots have experienced drastic population declines in recent decades, likely a result of overharvest of horseshoe crabs along the Atlantic coast. Horseshoe crabs are a major food source for red knots in breeding areas (Marks et al. 2016, http://explorer.natureserve.org).

Climate change may also have effects on migratory stopover habitat for the least tern, red knot and whooping crane. Impacts of climate change on the pine savanna aquatic and riparian ecosystems are less predictable than for other parts of the Custer Gallatin National Forest, in part because less is known about hydrologic flow regimes, but also because these systems are already very dynamic. Therefore, these habitats and the species that depend on them are well adapted to a high degree of variation in temperature, precipitation and stream flow conditions. In general, the pattern expected for the pine savanna ecosystem is warmer temperatures and static to slightly increased precipitation, with a net effect of less water available in summer months, as well as more extreme and variable weather events (Halofsky et al. 2018a). Such changes could affect food availability for the avian species addressed here. However, some of the impact may be moderated by stronger constraints on management actions within riparian habitats in the revised plan. A more thorough analysis of climate change impacts on grassland, riparian and aquatic habitats in the pine savanna ecosystem can be found in the Terrestrial Vegetation section as well as the Watershed and Aquatics sections of this document.

Environmental Consequences

Effects Common to all Alternatives

The least tern, whooping crane and red knot are all associated with open water or wetlands (NatureServe 2018). These are all migratory species, for which the Custer Gallatin National Forest provides potential stopover habitat during migration between breeding and wintering grounds. Stopover habitat for these species would also be open water or wetlands, which are protected by aquatic and riparian habitat plan components under all alternatives.

Management Direction under the Current Plans (Alternative A)

As noted above, the species addressed here are associated with the pine savanna ecosystem found in the Ashland and Sioux Geographic Areas. As such, existing plan direction applicable to these species is contained in the Custer National Forest Management Plan (1986, as amended). The Custer Plan contains a goal to provide habitat that contributes to the recovery of threatened and endangered species, with the objective of considering the needs of each species in site-specific analyses, through appropriate coordination and consultation with the U.S. Fish and Wildlife Service. The Custer Plan identifies all but the red knot as threatened or endangered species that may occur on the national forest, but notes that verified occurrences are rare, and dated. Further, the Custer Plan in 1986 included portions of present-day Dakota Prairie Grasslands, and it is unclear whether some of these rare sightings (such as for whooping crane) occurred within present-day Custer Gallatin units, or were in what is now the Dakota-Prairie Grasslands.

Aside from general plan components for threatened and endangered species, the Custer Plan contains no specific plan components for least tern, whooping crane or red knot. However, these species are all aquatic and riparian habitat associates. Custer Plan direction for riparian habitat is geared toward management for water quality and vegetation diversity, while protecting key wildlife habitat. Specific management practices are prescribed for riparian habitat (Management Area M). In addition, the Custer Plan provides direction for other resource areas, such as permitted livestock grazing, timber harvest, minerals management, recreation uses, and other uses to maintain or improve aquatic and riparian habitats.

Effects of the Current Plans

The Custer Gallatin does not provide breeding or wintering habitat for least tern, whooping crane or red knot, but parts of the national forest are located along seasonal migratory routes used by these species. Rivers, streams, wetlands, and riparian areas within the Ashland and Sioux Geographic Areas provide stopover habitat during migration periods for these species, although there has been no recent documented use. Detailed analyses of aquatic and riparian habitat conditions can be found in the Watershed Aquatic and Riparian Ecosystems section and the Terrestrial Vegetation section of this document. Since the Custer Plan contains specific direction for management of riparian areas, stopover habitat for migratory threatened and endangered avian species that may occur, but are unknown to occur on the Custer Gallatin, would likely be maintained or improved under the current Custer Plan. However, the language in the existing plan is somewhat vague and subject to interpretation, resulting in greater potential for intentional or unintentional impacts to aquatic and riparian habitats compared to the revised plan alternatives.

Management Direction under the Revised Plan Alternatives

Forestwide management direction (plan components) that may affect the species addressed in this section would be the same under all revised plan alternatives (alternatives B through E). These alternatives incorporate some existing direction, as well as new plan components that could impact habitat conditions for least terns, whooping cranes and red knots. Alternatives B through E include a desired condition that habitats contribute to recovery needs for federally listed species, as well as a guideline to protect airborne migratory species (FW-WL). The revised plan alternatives also contain descriptive desired conditions for grasslands, shrublands, deciduous forest, riparian areas and wetlands (FW-DC-VEGNF-04), which are important stopover habitats for the avian species addressed here. New plan components include guidelines for management actions within these habitats (FW-GDL-VEGNF), such as control of invasive species and conifer encroachment, promoting habitat diversity, and keeping new facilities out of sensitive areas. In addition, the revised plan alternatives also contain descriptive desired conditions for aquatic systems in general, such as watershed features, spatial connectivity of watersheds, and in-stream flows (FW-DC-WTR). Specific direction for aquatic and riparian habitat is much more detailed in alternatives B through E than in the current plan (alternative A). Riparian management zones are identified for application of plan direction.

Effects of the Revised Plan Alternatives

Compared to the current plans (alternative A), the more detailed and restrictive plan components in alternatives B through E would provide greater protection for aquatic and riparian habitats, as well as grasslands and shrublands that may be used as stopover areas during seasonal migrations by least terns, whooping cranes, and red knots. Under the revised plan alternatives, habitat conditions in general would be expected to improve. Detailed analyses for aquatic, riparian and grassland habitats can be found in the Watershed and Aquatics section, as well as the Terrestrial Vegetation section of this document. Individual projects would be designed so that the resulting habitat conditions contribute to the recovery needs for these species. In addition, special considerations for new wind energy developments would reduce the risk of wildlife collisions with associated facilities, which would reduce the potential for injury or mortality of the species addressed here.

Consequences to Federally Listed Species that May be Present but are Not Known to Occur from Forest Plan Components Associated with Other Resource Programs or Management Activities

Effects from Watershed, Riparian, and Aquatic Management

Revised plan alternative plan components associated with watershed, aquatic, and riparian ecosystems, as well as those associated with terrestrial vegetation set the coarse filter strategies that help maintain and restore habitats for wildlife, including federally listed species. The revised plan alternatives provide more detailed guidance than the current plans for protection of watersheds, riparian areas, and aquatic habitats. The revised plan alternatives include the adoption of riparian management zones, which are greater in size from the riparian zones currently identified for streams east of the Continental Divide. Specifically, the riparian management zone direction restricts management activities with few exceptions, to allow only those intended to restore, maintain or improve aquatic and riparian habitats. These components would protect or improve habitat conditions in areas that may serve as migratory stopover points for many avian species, including the federally listed species addressed in this section.

Effects from Vegetation Management

Vegetation management could affect migratory stopover habitats, in ways that may be beneficial, neutral, or harmful to the species considered here. Under all revised plan alternatives, timber harvest would be restricted in areas where watershed conditions may be damaged, and minimum impact suppression tactics would be used to minimize damage to riparian habitats from wildland fires.

Effects of Land Allocations for Recommended Wilderness and Backcountry Areas

Land allocations for Ashland and Sioux Geographic Areas (where the species addressed here may be present) include backcountry areas and recommended wilderness areas.

Under alternatives B and C, about 9 percent of the Ashland Geographic Area would be managed as backcountry areas with limited development. Backcountry areas in the Ashland Geographic Area are mostly (roughly 99 percent) within existing inventoried roadless areas. In addition to land use restrictions applied to inventory roadless areas (which are described in the Designated Areas section), backcountry areas forestwide do not allow new infrastructure such as roads, energy and utility corridors, and commercial communication sites, nor do they allow extraction of saleable mineral materials. Special use permits must be compatible with backcountry area character, and the areas are not suitable for timber production, although timber harvest may be used to achieve other resource needs (see Backcountry Areas FW-DC-BCA). In addition, backcountry areas in the Ashland Geographic Area would not be suitable for motorized or mechanized recreation use.

The Ashland backcountry areas are very similar to low development areas of the current Custer forest plan. Given the additional restrictions on management actions in backcountry areas, habitats in these areas would receive slightly higher protection under alternatives A, B and C than under alternative E. The backcountry areas in the Ashland Geographic Area contain wetlands and riparian areas that may provide potential stopover habitat for migrating least terns. The Ashland Geographic Area is outside the area where whooping cranes and red knots may be present during migratory stopovers. Land allocations for the Sioux Geographic Area do not vary between alternatives A, B, C and E, so effects to the federally listed species addressed here would be limited to those described above under Effects of the Revised Plan Alternatives.

Under alternative D, the Chalk Buttes unit in the Sioux Geographic Area would be managed as a backcountry area, receiving the same forestwide land use restrictions as described above for backcountry areas in the Ashland Geographic Area under alternatives B and C. However, this backcountry area would be suitable for motorized and mechanized recreation on existing routes open to such uses. There are small wetlands, grasslands, and riparian areas within the Chalk Buttes that may be used as stopover habitat by least terns, and these areas would receive the greatest protection from habitat alteration and human disturbance under alternative D. The Chalk Buttes are outside the area where whooping cranes and red knots may be present during migration.

Under alternative D, the land allocations change so that the habitats managed as backcountry areas in the Ashland Geographic Area under alternatives B and C would instead be managed as recommended wilderness. Recommended wilderness direction is similar to, but more restrictive than direction for backcountry areas. New recreation events are not allowed in recommended wilderness, and the areas are neither suitable for developed recreation sites, nor suitable for aircraft landing strips or recreational or commercial launching or landing of drones. Timber harvest is not allowed. The Ashland Geographic Area recommended wilderness areas in alternative D are similar in size and in the same locations as the backcountry areas in alternatives B and C, and include microsites of migratory stopover habitat for least terns. Additional restrictions for recommended wilderness would provide the best protection for these habitats, and would result in lower human disturbance in some areas that may occasionally or eventually be used by federally listed species.

There would be no additional land allocations in the Ashland or Sioux Geographic Areas under alternative E.

Effects from Permitted Livestock Grazing Management

In the pine savanna ecosystems where migratory stopover habitats for the least tern, whooping crane and red knot are located, livestock grazing has potential to affect habitat for these listed species. Riparian areas support higher bird diversity relative to the proportion on the landscape than any other habitat type. Just as these areas are important to birds and other wildlife, they also attract domestic livestock. Riparian areas can be seriously degraded by overgrazing (Rich et al. 2004). Under all revised plan alternatives, the plan would contain a desired condition that grazing allotments supply livestock forage and contribute to local ranching operations, while staying within or moving toward desired ecological conditions. Objectives are set for the number of animal unit months that could reasonably achieve this desired condition. A standard would require new or revised allotment management plans to design grazing practices to maintain or improve resiliency of riparian ecosystems and associated wildlife. Grazing-specific guidelines contain measures to maintain or improve stream habitat, water quality, and riparian habitat, including specific, quantifiable forage utilization measures within riparian areas.

Effects from Minerals Management

Under all revised plan alternatives, mineral and energy development activities include provisions to mitigate for hazardous conditions such as acid rock drainage, reclaim disturbed areas, and minimize adverse effects to aquatic and riparian resources. In addition, the plan would include components for infrastructure such as roads, trails and other facilities to minimize impacts to aquatic and riparian habitats and limit disturbance to associated species.

Effects from Infrastructure Management

Under all revised plan alternatives, infrastructure plan components address potential impacts from location of facilities, water drainage systems, sediment delivery, invasive species, barriers to aquatic organism passage, application of chemicals to road surfaces, and groundwater use developments.

Effects from Recreation Management

The revised plan alternatives contain a variety of components regarding the addition of new, and maintenance of existing, recreation facilities such as trails, campgrounds, picnic areas, etc., including an objective to remove or relocate some existing recreation facilities out of riparian areas. All revised plan alternatives would include desired conditions for recreation facilities to have minimal impacts on threatened and endangered species, as well as overall compatibility with natural resources. New developed sites would be designed to replace existing dispersed sites that are degrading riparian resources.

Cumulative Effects

Since the species addressed in this section are not currently known to occur on the Custer Gallatin National Forest, most of the cumulative impacts to these species result from past actions, as well as from impacts occurring on breeding or wintering grounds in locations far beyond the management jurisdiction for the Custer Gallatin National Forest. However, indirect effects of forest plan components on habitat conditions may combine with ongoing effects of human activities and other disturbances on or near the Custer Gallatin. Cumulative effects may also occur because of indirect effects of forest planning combined with possible future stressors, such as climate change. Key stressors, or threats to these species, were addressed above. Some of these threats still exist, but generally at much lower levels than occurred historically. For example, some native grasslands, including wetlands, are still being converted for agricultural, residential, or energy development purposes on other ownerships outside the national forest boundary, but this is a relatively minor factor in southeast Montana and northwest South Dakota compared with other parts of prairie ecosystems in the United States. DDT, the pesticide that impacted whooping crane populations during early and mid-20th century, has since been banned in the United States, but is still used in some countries where migratory bird species winter.

Finally, all of the species addressed in this section are federally listed as threatened or endangered, and as such, are protected under the Endangered Species Act. Therefore, land management actions on all lands in the United States along the migratory corridors for these species, including those adjacent to the Custer Gallatin National Forest, are subject to stipulations under the Act that prohibit any taking of, or causing intentional harm to these species or their habitats.

Conclusion

All alternatives would generally protect, maintain, or restore the grassland, shrubland, riparian and aquatic habitats that provide suitable migratory stopover habitat for least terns, whooping cranes and red knots. However, the revised plan alternatives (B through E) contain more specific language, more restrictions on certain types of management actions, and factors to address emerging issues to a greater degree than language in the existing plan (alternative A).

Collectively, plan components for managing permitted livestock grazing, vegetation management, mineral and energy development, and administrative and recreational facilities would help protect, maintain and restore aquatic and riparian habitats and minimize human disturbance in such habitats. Combined with the forestwide, comprehensive, detailed, and specific plan direction for aquatic, riparian and grassland habitats, the revised plan would provide better protection for, and potential improvement of, stopover habitats that may be used by least terns, whooping cranes or red knots, compared to the existing plan.

Canada Lynx (*Lynx canadensis*)

The Canada lynx is a medium-sized forest carnivore that is strongly associated with one primary prey species, the snowshoe hare (*Lepus americanus*). Both the lynx and its primary prey are highly adapted to survive in boreal climates, where winters are characterized by deep accumulations of soft, fluffy snow (Koehler and Aubry 1994). The lynx's long legs and large, furry feet that make it well-adapted to travel across deep snow in pursuit of hares, give this species a competitive advantage for hunting in wintery conditions over other more generalist predators such as bobcats (*Lynx rufus*), mountain lion (*Felis concolor*) and coyotes (*Canis latrans*) (Bell et al. 2016). Lynx and snowshoe hares are dependent on forested environments, where a diversity of structural stages may be used to meet various life cycle needs. The Canada lynx was listed as a threatened species under the Endangered Species Act in March 2000. Following this listing, critical habitat was designated for the Canada lynx in 2009, and then updated in 2014 (USDI FWS 2000, USDI FWS 2009, USDI FWS 2014a). As its name implies, the Canada lynx is mainly found in Canada, and its distribution is associated with the North American boreal forest habitats. In the northern part of their range including Canada, lynx populations cycle corresponding with fluctuations in snowshoe hare populations cycles. Lynx presence in the southern part of the range including the contiguous United States, is likely due in part, to influxes of dispersing lynx at the peak of population cycles in the north (Interagency Lynx Biology Team 2013). In the contiguous United States, lynx naturally occur at low densities compared with the larger population in Canada, because the habitat in the more southern latitudes is naturally more fragmented, as it transitions from true boreal forest of the north to boreal/subalpine and montane forests. This patchy habitat distribution limits densities of the lynx's primary prey species, the snowshoe hare, preventing both hare and lynx populations in the United States from reaching the high numbers found in Canada (USDI FWS 2000a).

In the western United States, lynx are most common in the northwestern part of Montana, decreasing in abundance to the south and east (Koehler and Aubry 1994). Lynx on the Custer Gallatin National Forest would be part of the Greater Yellowstone population. At the time the lynx was listed, the Greater Yellowstone Area was considered to be occupied by a small but persistent population of lynx (USDI FWS 2014a). While there is good evidence indicating lynx presence in the Greater Yellowstone Area over time, it is unclear whether lynx occupation of the area has been consistent, or whether a few individuals come and go relative to habitat conditions. It may be that lynx travel here and survive for a time when habitat conditions are good and hare densities are favorable, but those individuals either disperse or expire when conditions are less favorable and hare populations decline. In other words, this population may be one that "winks on and off" in terms of Canada lynx metapopulations in the contiguous United States. A recent status review conducted by the U. S. Fish and Wildlife Service in 2016 concluded there are likely fewer than 10 individual lynx, and possibly none, present in the entire Greater Yellowstone Area (Bell et al. 2016).

Analysis Area

Lynx habitat is only found in the montane ecosystem on the Custer Gallatin National Forest. Lynx analysis units provide a fundamental scale at which to evaluate and monitor the effects of management actions on lynx habitat. Lynx analysis units do not depict actual lynx home ranges, but their size and configuration generally approximates the scale of area used by an individual lynx, with habitat components necessary for year-round use by lynx. The montane geographic areas on the Custer Gallatin have been delineated into lynx analysis units based on presence of contiguous lynx habitat. However, because the forest plan neither mandates nor authorizes any site-specific actions, effects analyses for programmatic direction cannot be attributed to specific lynx analysis units with any degree of certainty. Therefore, the analysis area used to evaluate indirect and cumulative effects to lynx is the montane ecosystem, which includes the Bridger, Bangtail and Crazy Mountains; Madison, Henrys Lake, and Gallatin Mountains; Absaroka Beartooth Mountains, and Pryor Mountains Geographic Areas. The Ashland and Sioux Geographic Areas were excluded, since they do not produce boreal forest conditions suitable for lynx and snowshoe hares.

Affected Environment (Existing Conditions)

Lynx were historically present in low numbers on the Custer Gallatin National Forest, as evidenced by trapping and other records. However, total documented occurrences on the Custer Gallatin are rare, with the most recent in 2009. Low numbers of lynx recorded on the Custer Gallatin may reflect lynx habitat that is naturally fragmented by intervening open or drier habitats, resulting in patchy distribution, which provides rather marginal conditions for lynx due to limited capability to support snowshoe hares. Track and pellet surveys combined with incidental observations indicate that natural conditions on the Custer Gallatin support low densities of hares (Zimmer et al. 2008). The Greater Yellowstone Area is further from the true boreal forest of Canada than most other regions that support lynx in the contiguous United States. As part of the Greater Yellowstone Area, lynx habitat on the Custer Gallatin follows suit.

Most of the research on lynx in Montana has occurred west of the Continental Divide, where habitat conditions are more contiguous with lynx habitat in Canada, and generally more favorable for snowshoe hares and lynx with larger, more connected patches of boreal forest (Interagency Lynx Biology Team 2013). As a result, lynx habitat use patterns in the Greater Yellowstone Area, including the Custer Gallatin National Forest, are not well known, and lynx habitat indicators used in this analysis were derived from research on lynx in other areas, including northwest Montana.

Habitat Designations

In a Recovery Outline for Canada Lynx, the U. S. Fish and Wildlife Service (USDI FWS 2005) categorized lynx habitat in the continental United States as “core”, “secondary,” or “peripheral” based on historic and current occupation by lynx. Areas with verified records of lynx presence over time and recent evidence of reproduction are identified as core areas. Areas with historic records of lynx presence, but no documentation of reproduction, are identified as secondary areas. Peripheral areas are those with only sporadic detections of lynx. On the Custer Gallatin National Forest, the Absaroka Beartooth Mountains Geographic Area is identified as core habitat, the Bridger, Bangtail and Crazy Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas are classified as secondary lynx habitat, and the Pryor Mountains Geographic Area is identified as peripheral habitat. Secondary and peripheral habitat contribute to lynx distribution and persistence by providing dispersal habitat to and from core areas, but otherwise, the role of these areas in sustaining lynx populations remains relatively unknown (Interagency Lynx Biology Team 2013).

An important distinction for applying lynx habitat direction from the Northern Rockies Lynx Management Direction is whether lynx habitat is currently considered occupied as described in the recovery outline (USDI FWS 2005). Lynx habitat is considered occupied if there are at least two verified detections since 1999, of lynx that are not transient, or if there is evidence of reproduction (USDA FS and USDI FWS 2006). Based on lynx detections, the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas are considered occupied, even though lynx may be absent from these areas for periods of time. The isolated mountain ranges in the Bridger, Bangtail and Crazy Mountains and Pryor Mountains Geographic Areas are considered unoccupied (USDA FS 2007a). Although unoccupied areas may have occasional transient use by lynx traveling between more suitable habitats, such use is believed to be rare.

Habitat Suitability

In the contiguous United States, boreal forest transitions to subalpine and montane forest in the western states (Ruggiero et al. 2000). In these areas, including the Custer Gallatin, lynx habitat is typically found in the subalpine and upper montane forest zones. Lynx habitat is dominated by subalpine fir and Engelmann spruce, with increasing presence of lodgepole pine and pockets of aspen appearing toward the transition with upper montane forest types. In cool, moist conditions, Douglas-fir may be a minor component of lynx habitat in the upper montane forest zone, often in mixed forest that also contain subalpine fir, spruce, lodgepole pine or aspen. The warmer, drier forests dominated by Douglas-fir or limber pine do not support snowshoe hares or lynx (Interagency Lynx Biology Team 2013). Likewise, pure whitebark pine forest found at higher elevations generally do not provide the good snowshoe hare or lynx habitat, but whitebark pine may be found in mixed forest with spruce, subalpine fir or lodgepole pine in lynx habitat. Large meadows, alpine areas, rock and other non-forest types generally do not provide lynx habitat, but may be crossed by lynx moving between patches of suitable habitat.

Lynx use a variety of successional stages for different life cycle needs. Recent research (Holbrook et al. 2017, Kosterman et al. 2018), in northwest Montana examined habitat relationships in areas occupied by resident lynx. These studies confirmed that while a variety of boreal forest composition and structure is important, lynx use mature spruce-fir forest cover types more than any other forest structural stage or tree species. Proportion and connectivity of mature forest structure, along with interspersions of younger, smaller diameter, regenerating forest were shown to be of high importance for lynx. This relationship is largely driven by food availability, since the younger, regenerating forest supports the highest densities of snowshoe hares, but the mature forest structural stage is where lynx are able to hunt hares most efficiently.

Foraging habitat and reproductive denning habitat are the two factors of most importance to lynx. Lynx are strongly tied to their primary prey species, the snowshoe hare. Therefore, conditions that provide a prey base of hares also provide the best habitat for lynx. Snowshoe hares select for dense horizontal cover that provides hares with food, protection from predators and thermal cover from extreme weather conditions (Interagency Lynx Biology Team 2013). Winter is the most limiting time for lynx in terms of finding sufficient prey to survive. The lynx diet in winter is primarily restricted to snowshoe hares, due to both species’ adaptation to snow, combined with the ecology of alternate prey species and competing predators. Winter snowshoe hare habitat consists of places where young trees or shrubs grow densely, and are tall enough to protrude above average snowpack during winter, both in younger regenerating stands and multi-story mature stands (USDA FS 2007a).

Since lynx and snowshoe hares are snow-adapted species with strong ties to boreal forest conditions, climate change could influence the availability of winter snowshoe hare habitat and associated lynx foraging habitat. Climate change has been cited as one of the primary human-caused drivers influencing lynx habitat in the continental United States, and a number of studies that predict the ranges of both the lynx and snowshoe hare, will move northward and to higher elevations as temperatures increase due to global climate change. Shifting distribution of lynx and snowshoe hares may occur as a result of climate related factors such as changes in snow depth, condition or persistence; changes in the frequency and scale of natural disturbance events; and changes in predator-prey dynamics should lynx lose their competitive advantage in snow (Interagency Lynx Biology Team 2013). A variety of climate models predict that the Greater Yellowstone Area (including the Custer Gallatin) will experience a reduction in persistent snow cover, a change from boreal to temperate conifer forest types, and loss of potential lynx habitat by the year 2100 (Gonzalez et al. 2007). However, some experts have suggested that the Greater Yellowstone Area may have a future role as a refuge for lynx in the face of climate change, because of its relatively high elevation and associated potential to maintain winter snow levels and conditions (Bell et al. 2016). The summer diet of lynx may contain a broader range of prey species, including squirrels, grouse, beaver (*Castor canadensis*), mice, voles, shrews, weasels, fish, ungulates and ungulate carrion (Squires et al. 2010, Interagency Lynx Biology Team 2013). These food sources may be found in any stage of lynx habitat, and are less likely to be influenced by climate change.

Female lynx begin to reproduce at one to two years of age, and are capable of reproducing annually in good quality habitat with adequate prey. Breeding generally occurs in spring, with kittens typically born late April through May in Montana. Female lynx select areas with abundant coarse, woody debris, for reproductive den sites. Snags, logs, or root wads of fallen trees provide cover from predators and other environmental threats to lynx kittens. Denning areas must be reasonably close to foraging habitat; (high quality snowshoe hare habitat), so that the female lynx can hunt while leaving the kittens unattended nearby (Interagency Lynx Biology Team 2013). The amount of coarse woody debris is the key component of lynx reproductive denning habitat, rather than the age of the forest stand (USDA FS 2007a). The structural components of denning habitat may be present in younger forests affected by disturbance, as well as mature and older stands where tree mortality occurs as a result of disturbance as well as through natural aging processes. Climate change may also influence the availability of denning habitat. Warming temperatures relative to predicted precipitation levels are expected to result in larger, more frequent fires and other disturbances that produce the coarse woody material used by lynx as denning structure.

Other habitats used by lynx include boreal forest types in early- to mid-succession that lack the dense horizontal cover required by snowshoe hares, but still provide vegetative cover for lynx to travel through or rest in. These types include young to mature forests that result through natural succession as stands grow and lower branches are lost through the trees' self-pruning process, as well as mechanically thinned areas where tree spacing provides little horizontal cover for hares. Lynx will travel through these areas when moving between patches of snowshoe hare habitat, and may occasionally find alternate prey species in these areas (Squires et al. 2010). These stands may contain large logs and root wads, providing structure associated with denning habitat. Stands that currently have low horizontal cover have the potential to produce snowshoe hare habitat through natural succession as young trees and shrubs fill gaps, or through deliberate silvicultural management by opening the canopy to allow more light penetration to stimulate growth of grasses, forbs, shrubs and small trees in the understory (Zimmer et al. 2008, Holbrook et al. 2017a).

Finally, early stand-initiation stage lynx habitat has experienced recent disturbance such as stand-replacing fire, wind events, timber harvest, or other processes that removed or dramatically reduced live standing trees, temporarily reducing the suitability as foraging, denning, or daily travel areas for resident lynx. Warming climates are predicted to increase the frequency, severity and extent of natural disturbance processes, which could increase the proportion of lynx habitat in a condition that does not support snowshoe hares (Interagency Lynx Biology Team 2013). As these areas begin to regenerate, low-level vegetation may provide habitat for snowshoe hares and other prey species in summer, but would not provide winter snowshoe hare habitat until natural succession increases tree height and density to achieve adequate horizontal cover above average snow depth (USDA FS 2007a). Resident lynx tend to avoid, or travel quickly through large open areas (Squires, et al. 2010). However, Ruediger and others (2000) reported that dispersing lynx (for example those leaving their natal area or existing home range in search of a new home range) are known to travel through large areas of limited forest cover.

Lynx Habitat Modeling and Mapping

In 2010, the east-side national forests of the Northern Region (Helena, Lewis and Clark, Custer and Gallatin) began collaborating on a uniform method to map lynx habitat using habitat categories consistent with the Northern Rockies Lynx Management Direction. This effort, referred to as the "East Side Assessment," was intended to develop reliable, consistent habitat mapping and modelling protocols that could be used for mid- to large-scale assessments such as forest planning. Using the methods established in the East Side Assessment, a geographic information system (GIS) was used to estimate amounts of lynx habitat (key indicators above) within the national forest boundary. This habitat modeling exercise uses the Northern Region vegetation database (R1 VMap), which represents vegetative conditions based on remotely-sensed reflections of the Earth's surface (satellite imagery). Lynx habitat was predicted by selecting potential vegetation types that are deemed capable of producing the boreal-subalpine forest conditions preferred by lynx and snowshoe hares. Potential vegetation type is classified through a very coarse filter system for estimating plant community composition and structure based on site characteristics, resulting in a broad-scale prediction of indicated climax plant species. Forested habitats go through a range of successional stages from the time of setback due to disturbance until reaching the full site potential, or climax stage. Multiple forest succession stages may be used by lynx and snowshoe hares for different purposes. Therefore, the lynx habitat assessment was further refined through an evaluation of existing forest cover types based on dominant tree species, average tree size, canopy cover, and time since last known disturbance (Canfield 2016).

There is uncertainty in all models, and assumptions must be made to address this uncertainty. For this analysis, R1 VMap is the primary vegetation data set used to predict the amounts and distribution of various lynx habitat components. VMap is useful for estimating many aspects of potential lynx habitat. For example, it classifies vegetation by lifeform, such as conifer (tree), shrub, or herbaceous (grass/forb) plants, and can distinguish between vegetation and non-organic cover like rocks and water. It also contains information about dominant tree species, size class and canopy cover, which are good indicators of potential lynx habitat. However, understory structure (beneath the forest canopy) is important for lynx, as this component is what provides, or lacks, the dense horizontal structure needed by snowshoe hares for food and cover. Since VMap data are acquired remotely from satellites, understory structure is not well captured because the imagery often cannot penetrate through the forest canopy to reflect conditions in the understory. For this analysis, time since last disturbance, tree size, and canopy cover were assumed to provide reasonably accurate representations of forest structure, including the presence of dense horizontal cover in the understory. Further validation of lynx habitat types and structural stages are necessary at the project level.

Using the methods established in the East Side Assessment for lynx, and updating to incorporate Regional protocol for lynx habitat mapping (Marten 2016), potential lynx habitat was mapped for the montane ecosystem geographic areas. Results provided in this analysis reflect a point in time, and are subject to change over time. Lynx habitat components may change as a result of natural succession or disturbance. For example, an area currently in early stand-initiation stage (not yet providing winter snowshoe hare habitat), may grow and naturally progress into snowshoe hare habitat within the life of the forest plan. Similarly, an area of mature forest currently providing lynx denning or foraging habitat may revert to early stand-initiation stage not suitable as denning or foraging habitat, due to wildfire, vegetation management, or other disturbance events. Lynx habitat occurs over a large scale. The montane ecosystem of the Custer Gallatin covers well over 2 million acres. As such, remote sensing technologies were employed to collect and produce vegetation data over such a vast area. It has been acknowledged in a number of documents that refinements in lynx habitat mapping would occur as better data or technology become available (Ruediger et al. 2000, USDA FS 2007a, USDA FS 2007b, USDI FWS 2007, Interagency Lynx Biology Team 2013). It is expected that lynx habitat mapping for the Custer Gallatin will be updated with site-specific information collected at the project level, as well as at the landscape level as better information or technology become available.

Early stand initiation stage reflects recently disturbed habitat. This category is estimated based upon the potential vegetation type predicted to be boreal forest, combined with recent imagery indicating the lack of forest cover (VMap). Fire and timber harvest datasets indicate that these areas have been recently disturbed. As with other elements of the lynx habitat modeling process, assumptions are made for early stand-initiation stage that may affect the overall accuracy of habitat estimates. Areas that were previously forested and recently harvested or burned by high-severity fire are usually obvious and accurately represented by modeling. However, with no record of recent harvest or fire, some areas that are predicted (by potential vegetation type) to be capable of producing boreal forest conditions, but currently shown (by VMap) as having no trees present, are more difficult to assess. These areas may be capable of producing boreal forest cover types, but regeneration is slower or less evident, or they may have always been, or recently converted to, natural openings that will not likely grow dense trees in the future. To err on the conservative side, this analysis assumed these types are potential lynx habitat that is currently in an early stand initiation stage. This assumption may result in an overestimation of this particular component, and further validation will be needed at the project level to verify habitat conditions.

Winter snowshoe hare habitat most commonly develops in the stand initiation stage several years after a disturbance, or during understory re-initiation in mature and late successional forest structural stages (USDA FS 2007a). On the Custer Gallatin, stand-initiation stage snowshoe hare habitat can be detected with a reasonable level of accuracy from remotely sensed imagery, because the young trees are not shielded from view by overstory trees. Multi-storied forest structure can also be reasonably predicted based on stand age, dominant tree species, size class and canopy cover. However, the amount of horizontal cover (snowshoe hare habitat) is difficult to predict through a modeling process for reasons listed previously. It is likely that there is considerable overlap between stands modeled as “multi-storied mature” with those modeled as “other”; that is, it is quite possible that stands modeled as other habitat actually provide snowshoe hare habitat and vice-versa. Therefore, it is important that ground verification occurs at the project level.

Other lynx habitats include young to mature forests that have grown beyond the stand initiation stage, and have lost lower branches through a self-pruning process, or have been thinned through mechanical treatment or natural processes that leave many trees standing, but low levels of horizontal cover. These types of lynx habitat are modeled based on tree species dominance type, tree size class, and canopy cover. Mapping of these types is also susceptible to vulnerabilities of the modeling process described above; however there is reasonable consensus among Custer Gallatin foresters that these types of stands generally do not have well-developed understories (Canfield 2016).

Lynx Habitat Distribution on the Custer Gallatin National Forest

Lynx habitat is found only in the montane geographic areas on the Custer Gallatin. Within these geographic areas, only about 40 percent of the area contains the cool, moist boreal forest types that will support snowshoe hares and lynx. The term “lynx habitat” only refers to these types. The total amount of lynx habitat relative to other kinds of habitat remains relatively constant over time, but the various stages of lynx habitat (expressed below as a proportion of total lynx habitat) change over time through processes of disturbance and natural succession.

At the time of this analysis, the amount and proportion of early stand-initiation stage lynx habitat was quite low, at about 3 percent of the total lynx habitat across the entire montane ecosystem, and ranging from 2 percent in the Madison, Henrys Lake, and Gallatin Mountains and Bridger, Bangtail and Crazy Mountains Geographic Areas to 6 percent in the Absaroka Beartooth Mountains Geographic Area. The low percentage is generally reflective of most individual lynx analysis units as well, although three lynx analysis units with recent past fires are higher than the range stated for the geographic areas. Fire is the most common disturbance in lynx habitat. Typically, large stand replacing fires burn every 40 to 200 years, with smaller, lower intensity fires occurring in the intervals between stand-replacing fires (USDA FS 2007a). Large, stand-replacing fires in lynx habitat on the Custer Gallatin occurred in 2012, with the Millie Fire in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area and the Pine Creek Fire in the Absaroka Beartooth Mountains Geographic Area. Though these fires were large at over 10,000 acres each, they were small relative to the size of the geographic area in which they were located, and did not occur entirely in lynx habitat. At the time of this analysis, the most recent large-scale fire in lynx habitat was the Bacon Rind Fire, which burned roughly 3,500 acres on the Custer Gallatin near Yellowstone National Park, in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area. The extent to which this fire may contribute to early stand-initiation stage lynx habitat has yet to be determined.

Large-scale disturbances produce early stand-initiation habitats that are temporarily low quality habitat for snowshoe hares and lynx, but the affected areas often regenerate to produce high quality snowshoe hare habitat with dense young trees. On the Custer Gallatin National Forest, this process takes an average of about 16 years after the disturbance to produce the level of horizontal cover selected by hares, and stands can persist as snowshoe hare habitat for up to 40 years or more after a disturbance. Mature, multi-storied snowshoe hare habitat takes much longer to produce through natural succession, but there is currently a large proportion of mature and older successional forest habitat on the Custer Gallatin with potential to provide multi-storied snowshoe hare habitat. Currently on National Forest System lands, the younger stand-initiation stage snowshoe hare habitat component accounts for approximately 6 percent of lynx habitat, while the multi-story mature snowshoe hare habitat is estimated to occur in approximately 41 percent of lynx habitat. Combining the two indicates that nearly half (47 percent) of the lynx habitat on National Forest System lands is potential snowshoe hare habitat as of the time of this analysis. However, horizontal cover is difficult to detect or model using remotely sensed vegetation data, and the fact that snowshoe hares occur at lower densities on the Custer Gallatin than in more productive environments elsewhere suggests that the amount of snowshoe hare habitat may be overestimated, or it may be that the habitat is distributed over such a large area that snowshoe hares cannot make efficient use of it.

Looking at individual geographic areas, the Madison, Henrys Lake, and Gallatin Mountains Geographic Area has the most acres and greatest proportion of potential snowshoe hare habitat. The Pryor Mountains Geographic Area has the least total amount (acres) of snowshoe hare habitat, but due to its relatively small size and lower levels of recent disturbance, shows the second highest proportion of potential snowshoe hare habitat. The Bridger, Bangtail and Crazy Mountains Geographic Area has average proportion of snowshoe hare habitat, but relatively low acres compared to the larger geographic areas, while the Absaroka Beartooth Mountains Geographic Area has the lowest proportion of potential snowshoe hare habitat but second highest total acreage. The Absaroka Beartooth Mountains is by far the largest geographic area on the Custer Gallatin and also has the highest amount of recently disturbed lynx habitat with potential to grow into snowshoe hare habitat within the life of the forest plan.

Reproductive denning structure is an important element of lynx habitat that can occur across a variety of forest successional stages. Due to fairly regular large fires, wind events and widespread insect and disease outbreaks across the Custer Gallatin National Forest, coarse woody debris is generally abundant, and therefore potential lynx denning habitat is readily available and well-distributed throughout lynx habitat on the Custer Gallatin, although there are no recent records of lynx reproduction occurring here.

At the time of this analysis, about half of the lynx habitat on National Forest System lands was classified as other types that do not provide high-quality snowshoe hare habitat. Individual geographic areas range from the highest proportion of this type in the Absaroka Beartooth Mountains (at 58 percent of total lynx habitat), and the lowest in the Madison, Henrys Lake, and Gallatin Mountains (at 43 percent), but all geographic areas have a considerable amount of other lynx habitat. This proportion is reflective of individual lynx analysis units as well, although they span a larger range. The primary difference between areas identified as mature, multi-storied snowshoe hare habitat and those identified as other is the presence and amount of high horizontal cover, and since horizontal structure in the understory is difficult to model or estimate, there could be considerable overlap between these habitat components, emphasizing once more the need for further validation of lynx habitat mapping at the project level.

Research in northwest Montana where lynx are known to occur and snowshoe hares are relatively abundant indicates that it is not only the proportion of snowshoe hare habitat, but also the dominant tree species type, juxtaposition of early versus later successional habitat, and overall habitat connectivity that are important to lynx survival and reproduction (Holbrook et al. 2017, Kosterman et al. 2018). It is important to note that the habitat structural classes referenced in these studies are not directly comparable with structural classes used to develop the Northern Rockies Lynx Management Direction (USDA FS 2007a), which defines how lynx habitat was mapped for the Custer Gallatin National Forest. Further, since there are no known resident lynx on the Custer Gallatin at this time, there is no comparable data for lynx habitat use patterns within a known home range. However, these studies from northwest Montana present science that is meaningful for evaluating lynx habitat conditions in the plan area.

In northwest Montana, mature, spruce-fir forest types are used by lynx more than any other habitat conditions (Holbrook et al. 2017). These forest conditions are more readily available in northwest Montana than they are in southwest Montana on the Custer Gallatin National Forest. For example, on the Flathead National Forest, which makes up a considerable portion of the study area examined by Holbrook and others (ibid.), spruce and fir dominant forest cover types occur more frequently than any other tree species, ranging from 30 to 45 percent of the forested habitat at any point in time, and currently estimated at the high end of that range (USDA FS 2018). In contrast, the Custer Gallatin naturally produces spruce-fir dominated forest cover types in only 10 to 20 percent of the forested habitats, currently estimated at about 12 percent (Figure 3 in the Terrestrial Vegetation section). It is noteworthy that Holbrook et al. (2017) only looked at habitat within known lynx home ranges, and the figures reported above for the Flathead National Forest and the Custer Gallatin are forestwide. However, there are no known lynx home ranges to examine for the Custer Gallatin, and the Northern Rockies Lynx Management Direction does not break out lynx habitat in a way that is directly comparable to the science presented by Holbrook and associates (ibid.). Therefore, at this time, the best measures for comparison are the forestwide figures developed through forest plan revision for the two national forests.

In an earlier publication, Holbrook and others (2016) indicated that lodgepole pine is also an important tree species for snowshoe hares, particularly in winter, because lodgepole pine produces higher levels of digestible protein than other conifer species, including spruce and subalpine fir. Consistent with this research, Zimmer and others (2008), also showed lodgepole pine as an important food species for snowshoe hares on the Custer Gallatin National Forest. Lodgepole pine is widespread in the montane geographic areas on the national forest. It is most prevalent in the cool, moist potential vegetation types that produce lynx habitat, and is more abundant in these types than either Engelmann spruce or subalpine fir. However, spruce, subalpine fir and lodgepole pine often occur together in mixed conifer stands that are mapped as potential lynx habitat.

Currently on the Custer Gallatin, mature to late seral stage lynx and snowshoe hare habitat is predicted to occur in greater proportion than the younger, regenerating snowshoe hare habitat, a pattern that is consistent with conditions in occupied lynx home ranges in northwest Montana. These relative proportions hold true at the geographic area scale, as well as for most individual lynx analysis units on the Custer Gallatin. However, the distribution, juxtaposition and overall connectivity of potential snowshoe hare habitat on the Custer Gallatin tends to be more disjointed than that indicated for occupied lynx territories in northwest Montana. While there are large amounts of mature and older lynx habitat in all geographic areas as well as individual lynx analysis units, the younger, stand-initiation stage snowshoe hare habitat is more concentrated in areas of past large-scale fires, which occurred mainly in the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas. As a result, there is generally good connectivity in mature and older lynx habitat across the Custer Gallatin, which is important for snowshoe hares and lynx. However, at the lynx analysis unit scale, there is currently less of the younger, advanced regeneration habitat shown by Holbrook and associates (2016), to produce higher densities of snowshoe hares.

Kosterman and others, reported that large amounts of highly connected mature forest are required by reproductive female lynx in northwest Montana. The Greater Yellowstone Ecosystem (of which the

Custer Gallatin is a part) is generally higher elevation, more open, and often more precipitous than northwest Montana, resulting in a more non-forest, drier forest, and steep, rocky terrain conditions that do not support snowshoe hares or lynx. These habitats are often interspersed among the boreal forest types that could support lynx, producing more patchy overall conditions with naturally lower connectivity than found in northwest Montana (USDI FWS 2014a). It should be noted that Kosterman and colleagues (2018) looked at 50 percent annual home ranges or "core areas" for female lynx, which is a subset of the total annual home range for individuals, and therefore not directly comparable to the lynx analysis unit scale used in the Northern Rockies Lynx Management Direction. Across the montane ecosystem of the Custer Gallatin, over 60 percent of the mature forest types (average tree size greater than 10 inches diameter dominated by lodgepole pine or spruce and fir cover types), have a contiguous patch size of greater than 100 acres (table 44, patch size distribution in the Terrestrial Vegetation section), suggesting a pattern of reasonably good connectivity for mature forest lynx habitat on the Custer Gallatin at the time of this analysis. However, these figures represent conditions across the entire montane ecosystem, since lynx habitat mapped per the Northern Rockies Lynx Management Direction for the Custer Gallatin has not been measured in the same way as Kosterman and associates (ibid.), and there are no known reproductive female lynx home ranges on the Custer Gallatin to use for comparison purposes.

Finally, not all habitat types within the montane geographic areas are considered lynx habitat. Warmer, drier forested types, as well as non-forest types do not provide boreal forest conditions selected by lynx or snowshoe hares. These habitat types are interspersed with, or surrounding lynx habitat within the montane ecosystem, and account for considerable proportions of each of the montane geographic areas, as well as individual lynx analysis units. About 60 percent of the National Forest System lands within the montane ecosystem are classified as non-habitat for lynx. These areas do not currently provide habitat suitable for lynx or snowshoe hares, nor do they have the site potential to become good lynx habitat over time. Lynx and snowshoe hares may travel quickly through such areas, but are not expected to reside in these habitats. The Absaroka Beartooth Mountains Geographic Area has the largest acreage of non-lynx habitat due primarily to the considerable amount of area above timberline. The Pryor Mountains Geographic Areas has the lowest acreage of non-lynx habitat, but the highest proportion given its relatively small size. Table 55 and table 56 represent current estimates of lynx habitat by geographic area for all ownerships and for National Forest System lands only.

Table 55. Lynx habitat, all ownerships

Geographic Area	Total Acres	Total Lynx Habitat[1]	Percent[2] Early Stand Initiation	Percent[2] Snowshoe Hare	Percent[2] Other	Percent[1] Non-lynx Habitat
Absaroka Beartooth Mountains	1,387,824	408,644 29%	6%	36%	58%	71%
Madison, Henrys Lake, and Gallatin Mountains	952,813	519,930 55%	2%	54%	44%	45%
Bridger, Bangtail and Crazy Mountains	314,598	180,956 58%	2%	47%	51%	42%
Pryor Mountains	77,944	13,831 18%	3%	52%	45%	82%
Totals	2,733,179	1,123,361 41%	3%	46%	51%	59%

1. Percent = proportion of total acres
2. Percent = proportion of lynx habitat acres

Table 56. Lynx habitat, National Forest System (NFS) lands only

Geographic Area	Total NFS Acres	Total Lynx Habitat[1]	Percent[2] Early Stand Initiation	Percent[2] Snowshoe Hare	Percent[2] Other	Percent Non-lynx Habitat[1]
Absaroka Beartooth Mountains	1,353,295	398,811 29%	6%	36%	58%	71%
Madison, Henrys Lake, Gallatin Mountains	805,299	447,520 56%	1%	56%	43%	44%
Bridger, Bangtail and Crazy Mountains	205,025	123,371 60%	1%	49%	50%	40%
Pryor Mountains	75,067	13,707 18%	3%	52%	45%	82%
Totals	2,438,685	983,409 40%	3%	47%	50%	60%

1. Percent = proportion of total National Forest System acres
2. Percent = proportion of National Forest System lynx habitat acres

Designated Critical Habitat

Lynx habitat is based on site potential to produce boreal forest conditions. In addition, the U. S. Fish and Wildlife Service designated critical habitat for lynx in 2009, and later revised the designation in 2014. The Custer Gallatin National Forest is part of the Greater Yellowstone Area (Unit 5) of critical habitat for lynx. Areas designated as critical habitat contain the primary constituent elements, or those specific elements of physical or biological features that provide for a species' life history processes and are essential to the conservation of the species. Primary constituent elements specific to lynx in the contiguous United States include boreal forest landscapes supporting a mosaic of differing successional forest stages containing:

a. Presence of snowshoe hares and their preferred habitat conditions, which include dense understories of young trees, shrubs or overhanging boughs that protrude above the snow, and mature multi-storied stands with conifer boughs touching the snow surface;
b. Winter conditions that provide and maintain deep fluffy snow for extended periods of time;
c. Sites for denning that have abundant coarse woody debris, such as downed trees and root wads;
d. Matrix habitat (such as hardwood forest, dry conifer forest, non-forest, or other habitat types that do not support snowshoe hares) that occurs between patches of boreal forest in close juxtaposition such that lynx are likely to travel through such habitat while accessing patches of boreal forest within a home range (USDI FWS 2014a).

Critical habitat is designated in those portions of the Custer Gallatin with the highest potential to support residential lynx use over time. Roughly 56 percent of the montane ecosystem containing lynx habitat is designated critical habitat, which is all located in the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas. The areas with potential lynx habitat outside of designated critical habitat contain conditions that may support transient use by lynx, but are not considered to provide adequate quantities or combinations of elements essential to meeting all life cycle needs of the lynx.

As with lynx habitat, critical habitat components change over time. For example, an area that provides stand-initiation stage snowshoe hare habitat today, may grow, drop lower branches, and no longer provide snowshoe hare habitat within a relatively short amount of time. Quantities of snowshoe hare habitat and denning habitat (primary constituent elements (a) and (c) above) are estimates as of the time this analysis was prepared. Primary constituent element (a), winter snowshoe hare habitat, was described above in terms of lynx foraging habitat. An estimated 18 percent of the designated critical habitat on the Custer Gallatin National Forest is predicted to provide snowshoe hare habitat.

Element (b), winter snow condition, is less well-defined and difficult to quantify, but because both the lynx and snowshoe hare are morphologically adapted for efficient travel over deep, soft snow, winter snow conditions are important. The Custer Gallatin National Forest is part of the Greater Yellowstone Area Unit of designated critical habitat for lynx. This unit is at higher elevation than most other areas that support lynx. Winters can be severe here, and deep snow is rarely in short supply. However, because the Greater Yellowstone Area is naturally more open than other areas that support lynx, snow may be more exposed to sun and wind, which can form crust on the snow surface. Freeze-thaw events, or wind loading, can change the consistency of snow, which may affect the competitive advantage for lynx. Snowpack accumulation has been on a downward trend since historic times, and much of this is attributed to lower levels of winter precipitation in the interior northern Rocky Mountains (Luce *in* Halofsky et al. 2018a), which includes the montane geographic areas of the Custer Gallatin. Over the expected life of the forest plan, average daily temperatures are predicted to increase, including winter temperatures. Precipitation is also expected to increase slightly, but there is greater uncertainty about projections for precipitation than for temperatures (Joyce *in* Halofsky et al. 2018a). Projected increases in precipitation are not expected to offset effects of warming temperatures. Snow water equivalent is expected to decline, which could affect snow consistency and persistence. The dense forest canopy associated with boreal forest types (lynx habitat) generally helps retain snowpack and snow consistency, and the dominant tree species in lynx habitat (lodgepole pine, Engelmann spruce, and subalpine fir) have shown high resiliency to past climate fluctuations (Hansen et al. 2018). Reduced snow accumulation, changes in snow consistency and persistence could affect the competitive advantage lynx have over other predators in winter (Interagency Lynx Biology Team 2013).

Element (c), denning habitat, was also described above for lynx habitat in general. Due to recent disturbance processes such as fire, wind, insects and disease, tree mortality has been widespread across the Custer Gallatin in recent years, and as a result, coarse woody debris such as down trees and rootwads are abundant and well distributed in lynx habitat. Roughly 38 percent of the National Forest System lands in designated critical habitat are predicted to contain both the boreal forest attributes of lynx habitat in general, as well as the down, woody materials used by lynx for denning purposes. Denning habitat may also provide snowshoe hare habitat, which is ideal for lynx, but not all potential denning habitat contains adequate horizontal cover for snowshoe hares. Therefore, proximity of denning habitat to snowshoe hare habitat is also important for lynx. Because coarse, woody debris is currently abundant and widespread across the montane ecosystem, denning habitat for lynx is not currently a limiting factor. Given the nature and frequency of disturbance events in the montane ecosystem of the Custer Gallatin, denning habitat is likely to remain readily available over the life of the forest plan.

Element (d), matrix habitat, is a catchall for habitat that does not provide the cool, moist, dense vegetation and snowy conditions important to lynx and snowshoe hares. This habitat includes drier forest types as well as natural openings that do not produce the dense horizontal cover required by snowshoe hares. Since matrix habitat contains neither suitable habitat for snowshoe hares, nor the site potential to become suitable for hares over time, it does not provide current or future foraging opportunities for lynx. However, matrix habitat may be intermingled with snowshoe hare habitat such that lynx are likely to travel through it to access better hunting grounds. Because boreal forest types are naturally fragmented and patchily distributed on the Custer Gallatin National Forest, a considerable amount (approximately 57 percent) of the designated critical habitat on National Forest System lands falls into the matrix category. Table 57 and table 58 summarize the amounts and proportions of primary constituent elements within designated critical habitat for lynx by geographic area for all ownerships and for National Forest System lands only.

Table 57. Designated critical habitat for lynx, all ownership

Critical Habitat	Total Acres (%)[1]	Total Lynx Habitat (%)[2]	Snowshoe Hare (%)[2]	Denning (%)[2]	Matrix (%)[2]
Absaroka Beartooth Mountains	1,056,849 76%	382,643 36%	13%	31%	64%
Madison, Henrys Lake, Gallatin Mountains	377,837 40%	251,849 67%	33%	60%	33%
Totals	1,434,687 52%	634,492 44%	**29%**	**39%**	**56%**

1. Percent = proportion of total acres in the geographic area
2. Percent = proportion of total designated critical habitat acres

Table 58. Designated critical habitat for lynx, National Forest System (NFS) lands only

Critical Habitat	Total NFS Acres (%)[1]	Total Lynx Habitat (%)[2]	Snowshoe Hare (%)[2]	Denning (%)[2]	Matrix (%)[2]
Absaroka Beartooth Mountains	1,038,330 77%	374,976 36%	13%	31%	64%
Madison, Henrys Lake, Gallatin Mountains	323,325 40%	215,194 67%	35%	61%	33%
Totals	1,361,655 56%	590,170 43%	**18%**	**38%**	**57%**

1. Percent = proportion of total National Forest System acres in the geographic area
2. Percent = proportion of National Forest System lands designated critical habitat acres

Key Stressors

Lynx populations occur at low densities in the continental United States relative to lynx populations in Canada, and this has likely been the case historically, due to naturally fragmented and lower quality habitat for lynx and their primary prey species, the snowshoe hare (USDI FWS 2000). The Greater Yellowstone Area, which includes the Custer Gallatin National Forest, is further south than most other areas of the United States that currently support lynx, and it is geographically isolated from source populations in Canada. Habitat for lynx on the Custer Gallatin is naturally fragmented and patchily distributed, due to relatively high elevation, extreme topography and related ecological conditions, resulting in marginal habitat for snowshoe hares and lynx.

Due to the strong association between lynx and snowshoe hares, the primary system drivers that affect lynx are those events or processes that affect snowshoe hare habitat and populations. Natural factors that affect these conditions in the plan area include climate, topography, soil conditions, disturbance and forest succession.

Other predators may compete with lynx for access to prey species, or prey directly on lynx (Interagency Lynx Biology Team 2013). The Custer Gallatin hosts a complex suite of native predators, including large, medium, and small mammals as well as avian species, most of which will take snowshoe hares as prey if the opportunity presents. Mountain lions, coyotes, wolverines (*Gulo gulo*), and wolves (*Canis lupus*), which are all common or at least present on the Custer Gallatin, all have been known to prey on lynx.

Due to their affiliation with deep, soft snow conditions, winter management and recreation activities that result in snow compaction have potential to affect snowshoe hares and lynx.

Lynx were legally harvested (mainly trapped) as a furbearer species in Montana until they were listed as threatened under the Endangered Species Act in 2000, at which time trapping and snaring of lynx became prohibited. However, as with most wild cats, lynx are vulnerable to trapping and can be inadvertently caught in traps legally set for other furbearer species (Interagency Lynx Biology Team 2013).

Vegetation management activities such as timber harvest and prescribed fire have the potential to affect lynx habitat in ways that can be detrimental, neutral or even beneficial to lynx. Fire suppression, fuels treatment and habitat fragmentation associated with roads pose potential threats to lynx related to vegetation management (USDI FWS 2014a).

Since lynx and snowshoe hares are snow-adapted species with strong ties to boreal forest conditions, climate change is a potential stressor and possible driver for persistence of these species on the Custer Gallatin and elsewhere in the contiguous United States (Gonzalez et al. 2007).

Environmental Consequences

Management Direction under All Alternatives

All alternatives, including the current plans (alternative A), incorporate Northern Rockies Lynx Management Direction (USDA FS 2007a). The direction includes goals, objectives, standards, and guidelines common to 18 national forests in the continental United States, including the existing Custer and Gallatin plans. The Northern Rockies Lynx Management Direction would be adopted in its entirety under all revised plan alternatives. Plan components from the Northern Rockies Lynx Management Direction are designed to conserve and promote recovery of the Canada lynx. The direction applies to all National Forest System lands that are known to be occupied by Canada lynx. For areas of the Custer Gallatin with potential lynx habitat that are currently considered unoccupied by lynx, the Northern Rockies Lynx Management Direction is to be considered when planning and designing management actions, but does not need to be strictly adhered to. See the discussion in the Affected Environment section for more detailed information about occupied and unoccupied lynx habitat.

The Northern Rockies Lynx Management Direction contains standards to maintain lynx habitat connectivity within and between lynx analysis units, by limiting permanent development and vegetation management, as well as requiring identification of potential crossing areas for highway construction in linkage areas. Vegetation management standards limit actions that produce early stand initiation stage forest (habitat that does not provide forage or cover for snowshoe hares or lynx). Standards also restrict the amount of precommercial thinning and other vegetation treatments that could reduce existing snowshoe hare habitat. Exemptions to these standards allow for fuel treatment within the wildland urban interface. The Northern Rockies Lynx Management Direction also contains a number of guidelines that address factors such as maintenance of habitat for alternate prey species and distribution of denning habitat for lynx. Guidelines are also included to make livestock grazing practices compatible with conserving lynx habitat, as well as to manage human uses such as recreation, travel, mineral and energy development to maintain lynx habitat conditions and connectivity, and to limit human-caused snow compaction in lynx habitat.

Effects Common to all Alternatives

Under all alternatives, the Custer Gallatin National Forest would continue to operate under the Northern Rockies Lynx Management Direction, as well as additional plan components that may affect habitat for snowshoe hares and lynx. A full analysis of the potential impacts of implementing the Northern Rockies Lynx Management Direction was done when the direction was amended to existing plans, and this can be found in the documents final environmental impact statement (USDA FS 2007a), as well as the associated biological assessment (Bertram 2007) and the recently completed biological assessment for designated critical habitat (Conway and Hanvey 2017). These analyses are not repeated here, but key parts are referenced where pertinent to specific conditions on the Custer Gallatin National Forest.

Continued implementation of the Northern Rockies Lynx Management Direction would conserve lynx habitat under all alternatives by ensuring that adequate habitat and connectivity are maintained, and by limiting management actions that convert lynx habitat to early stand initiation conditions that are temporarily unsuitable for use by snowshoe hares and lynx. Management actions that increase early stand-initiation stage habitat are not prohibited, because such areas eventually regenerate, and have the potential to produce high quality snowshoe hare habitat over time. Rather, management actions may contribute to the amount of early successional stage habitat unless 30 percent or more of the mapped lynx habitat within a lynx analysis unit becomes unsuitable due to natural processes or management actions. In addition, management actions may not convert more than 15 percent of mapped lynx habitat within a lynx analysis unit to early stand initiation stage in a 10-year period. These measures limit the amount of habitat that is temporarily unsuitable for snowshoe hares and lynx, but allow for management actions to help replenish the young, dense stand initiation stage forest that provides high quality snowshoe hare habitat, and provide guidance for how and where such treatment should occur.

Core habitat for lynx on the Custer Gallatin is located in the Absaroka Beartooth Mountains Geographic Area, most of which is within designated wilderness. Timber harvest is prohibited and fire suppression has been negligible in the wilderness area. Outside of wilderness, a substantial portion of the lynx habitat in this geographic area is within inventoried roadless areas, which have fewer restrictions than wilderness, yet some limitations are placed on certain management actions. As a result, natural disturbance and successional processes have largely shaped lynx habitat conditions in core habitats. Similarly, most of the secondary habitat on the Custer Gallatin that is considered occupied, is in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area, which contains designated wilderness (Lee Metcalf), the Cabin Creek Wildlife and Recreation Area, and the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area. These designated areas all have land use restrictions that provide some level of protection for lynx habitat. Secondary unoccupied lynx habitat is found in the Bridger, Bangtail and Crazy Mountains Geographic Area. While there is some inventoried roadless area in this geographic area, there is no designated wilderness, and more of the lynx habitat in this geographic area is in multiple use lands open to a wider variety of management actions, compared to the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas. Finally, only peripheral lynx habitat is found in the Pryor Mountains Geographic Area. See the Designated Areas section for a detailed description of these special designations and associated land use restrictions. While many of the designated areas apply land use restrictions that protect lynx habitat from permanent alterations, these areas also limit the potential to use tools like timber harvest or prescribed burning to improve lynx habitat through deliberate creation of young, regenerating snowshoe hare habitat.

Vegetation management, such as mechanical timber harvest and prescribed fire, can have negative impacts to lynx by removing, or reducing the high horizontal structure near the ground that supports snowshoe hare use year round, but most importantly in winter. The Northern Rockies Lynx Management Direction limits such impacts by allowing management-related reductions in snowshoe hare habitat only for fuel treatment purposes in wildland urban interface areas and other minor administrative purposes outside of wildland urban interface. Allowable impacts to snowshoe hare habitat are capped at no more than 6 percent (cumulatively) of the total mapped lynx habitat on the national forest, and no more than 6 percent of the mapped lynx habitat within designated critical habitat. On the other hand, vegetation management guidelines in the Northern Rockies Lynx Management Direction benefit lynx habitat by promoting projects that recruit a high density of conifers, hardwoods, and shrubs where such habitat is scarce or not available, providing habitat for alternate prey species, and ensuring that denning habitat is present and well distributed within individual lynx analysis units. Guidelines conserve lynx habitat by advising against construction of permanent firebreaks on ridges or saddles that may serve as important travel corridors for lynx.

Since a large proportion of lynx habitat is within wilderness and other designations that limit management actions, natural disturbance processes are, and will continue to be, the primary factor driving lynx habitat conditions on the Custer Gallatin. Therefore, it makes sense that the effects of management actions implemented under the forest plan would not vary appreciably by alternative. The SIMPPLLE model was used to evaluate this notion by predicting changes to lynx habitat structural stages over time, including those anticipated from management actions constrained by lynx management direction, as well as changes due to natural disturbance events. As expected, when both management and natural processes were simulated over a 50-year period into the future, there was no notable difference at the geographic area scale between plan alternatives that could be attributed to management actions. Under all alternatives, this exercise predicted that within the life of the plan, the amount of stand initiation stage snowshoe hare habitat would increase relative to early stand initiation habitat for the first two decades, then the trend would reverse between the second and third decade. Likewise, the amount of multi-storied snowshoe hare habitat is predicted to increase relative to other habitat over the first two decades, and that trend would also reverse between the second and third decades (see figure 31). Again, these trends are largely driven by natural disturbance processes, because the amount of management actions that could affect lynx habitat would be limited by lynx management direction, management restrictions in designated areas, and budget constraints. It should be noted that SIMPPLLE is a simulation model that runs on a different data set, with slightly different parameters than the GIS queries used to model lynx habitat for current conditions. What is meaningful from the SIMPPLLE exercise are the predicted trends, not the actual numbers generated.

Young trees and shrubs provide forage and cover for snowshoe hares, and livestock grazing can impact lynx and snowshoe hare habitat if trampling or browsing by domestic animals prevents trees and shrubs from regenerating after a disturbance, or if livestock use reduces shrub cover in important secondary habitats such as aspen stands, willow carrs, and shrub-steppe habitats. The Northern Rockies Lynx Management Direction contains guidelines to prevent these impacts, which would conserve lynx habitat in a similar manner under all alternatives.

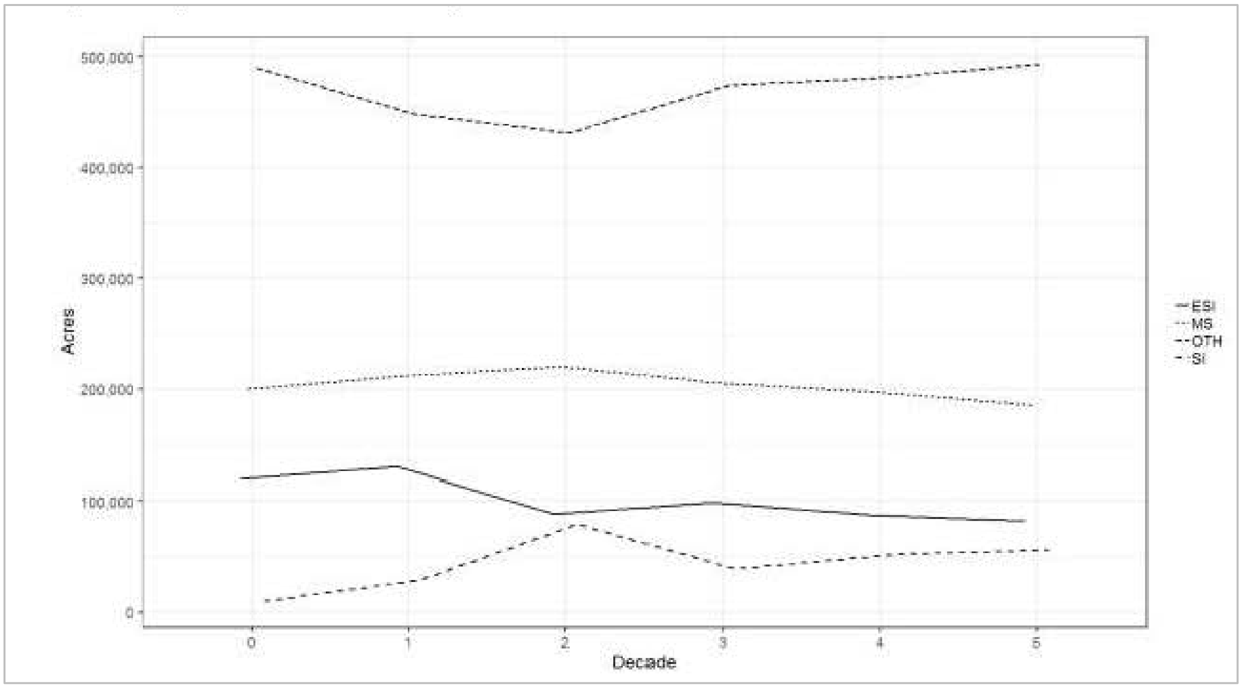

Figure 31. Lynx habitat structure by decade; ESI = early stand initiation; MS = multi-storied; OTH = other; SI = Stand initiation

A variety of additional human uses can impact lynx by fragmenting habitat with permanent developments. Winter use that results in snow compaction may reduce the competitive advantage lynx have over more generalist predators in deep, soft snow conditions. Continuing to follow the Northern Rockies Lynx Management Direction would conserve lynx habitat by ensuring that placement of new permanent roads and developments maintains habitat connectivity for lynx, concentrating human use in existing developed areas, designing ski area development or expansion to maintain some suitable habitat for lynx and hares, designing reclamation plans to restore lynx habitat, and limiting snow compacting activities to existing designated routes and areas.

Effects of the Current Plans

Under the current plans, the Northern Rockies Lynx Management Direction is the only plan language that is specifically directed at conservation of lynx, and by association, snowshoe hare habitat. However, both the existing (Custer and Gallatin) plans contain language geared toward recovering threatened species through habitat conservation and coordination with the U.S. Fish and Wildlife Service. In addition, both plans contain direction to provide habitat diversity by managing for a variety of age and size classes and associated successional stages within forested habitat, as well as forestwide (Gallatin) and area-specific (Custer) direction for management of snags and coarse woody debris. Forest successional stage and structural diversity is important for snowshoe hares and lynx, while snags and coarse woody debris are components of lynx denning habitat. Under the existing plans, habitat for snowshoe hares and lynx would be conserved by following the Northern Rockies Lynx Management Direction. Additional language in existing plans is complementary to the Northern Rockies Lynx Management Direction, and may contribute to the creation or maintenance of lynx habitat, but is not specifically designed to do so. Both existing plans also contain management direction that affords some protection of riparian areas and associated vegetation, which can provide foraging and denning habitat for lynx. Riparian areas also provide habitat connectivity, and may be used as travel corridors by lynx, so limiting impacts in these areas will help to conserve lynx habitat.

Management Direction under the Revised Plan Alternatives

Like the current plans, the revised plan alternatives would all carry forward all plan components from the current Northern Rockies Lynx Management Direction. In addition to this plan direction, the revised plan alternatives contain a desired condition for habitat that contributes to species recovery needs, population trends that are stable to increasing across the species' range, and for critical habitats designated by the U.S. Fish and Wildlife Service to provide the physical and biological features identified as essential to the conservation of the species. Specific to lynx, the desired condition is for habitat with diverse structure to provide for the various life cycle needs of lynx, and habitat connectivity to facilitate lynx movement between boreal forest patches within a home range as well as dispersal between lynx analysis units. In addition to plan components specific to lynx, the revised plan alternatives provide substantial detail regarding the desired extent, frequency, and severity of ecosystem processes, which in turn, drive ecological structure, composition and function, ultimately resulting in the habitat diversity important to lynx. General wildlife plan components include a desire for vegetation conditions that are generally within the natural range of variation to provide habitat for assorted life cycle needs of a diverse suite of wildlife species. The revised plan alternatives include quantitative estimates of the natural range of variation for key ecological characteristics of forested habitats (see tables in the Terrestrial Vegetation section), which would guide management actions and facilitate monitoring for changes in lynx habitat over time. The revised plan alternatives include guidelines for management of old growth forest, large tree structure, and snags, which are important elements of lynx habitat. Similarly, the alternatives provide specific plan components for deciduous woodlands and shrublands that can be important secondary habitat for lynx (see the Terrestrial Vegetation section for details). Additionally, the revised plan alternatives include a comprehensive set of detailed and specific plan components for protection of riparian areas, which can function as snowshoe hare habitat (lynx foraging habitat), reproductive denning habitat for lynx, and also potential travel corridors for lynx to move between patches of boreal forest habitat. The alternatives include plan components for other wildlife species that could affect management actions in lynx habitat. For example, inside the recovery zone for grizzly bears *(Ursus arctos*), all revised plan alternatives require maintenance of secure habitat, limits to livestock grazing, and constraints on developed sites. Within maternal habitat for wolverines, the alternatives would limit increases in special use authorizations that could affect snow conditions. Finally, the revised plan alternatives identify key linkage areas and provide land use restrictions beyond those specifically required for lynx habitat connectivity under the Northern Rockies Lynx Management Direction.

Effects of the Revised Plan Alternatives

Compared to the current plans, coarse filter plan components for the revised plan alternatives provide a clearer trajectory for desired vegetation conditions, which would promote biodiversity, and maintain or restore ecological integrity by managing habitats within a range of conditions to which lynx have adapted use patterns over time. The fine filter components contained in the Northern Rockies Lynx Management Direction, as well as those listed above for other species, would limit potential impacts to lynx habitat to a greater degree than is likely to occur with the existing plans.

Consequences to Canada Lynx from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Fire and Fuels Management

Fire is the predominant disturbance process that affects forested habitats in the northern Rockies, and is an ecological factor to which lynx and their primary prey have adapted over time. Wildland fire has potential to affect habitat in ways that are negative, neutral or beneficial to lynx. While fire is widespread and often occurs at large scales, it rarely produces uniform burn patterns. Different forest conditions, weather patterns and topography can affect fire behavior. Variations in burn patterns can create a diversity of age and density structure within and between forest stands. High-intensity, stand-replacing fires can remove cover and forage for snowshoe hares, reducing potential foraging habitat and security cover for lynx. If fires reduce a large proportion of snowshoe hare habitat at the scale of a lynx home range, negative consequences to lynx would be expected over the short term. However, fires that burn in a mosaic pattern can create the diversity of habitat conditions required by lynx over a home range scale. Fires that burn in warm, dry forest types, shrublands and grasslands have little impact on lynx or snowshoe hares.

All revised plan alternatives contain desired conditions for wildland fires that burn with a range of intensity, severity and frequency that allows ecosystems to function in a resilient and sustainable manner, and vegetation conditions that support natural fire regimes. These are conditions to which lynx have adapted, and the conditions are expected to provide sustainable habitat for lynx over time and contribute to recovery of the species. The exception occurs in the wildland urban interface, where the desired condition is for vegetation that supports low-intensity fire in order to protect infrastructure and other values at risk. Hazardous fuel management would be used in the wildland urban interface to achieve this desired condition. Fuel treatments in the wildland urban interface are expected to occur under all revised plan alternatives at relatively similar levels, with objectives for hazardous fuel mitigation projects ranging from a low of about 4,000 acres per year under alternative E to a high of roughly 7,000 acres per year in alternative D. Not all fuel reduction projects would affect lynx habitat, since some treatment would occur in warm, dry forest types that do not support snowshoe hares, so effects to lynx would be less than the stated objectives. The Northern Rockies Lynx Management Direction would apply restrictions on fuel reduction projects in wildland urban interface areas, which would limit impacts to lynx and snowshoe hare habitat in a similar manner across all alternatives.

Outside of the wildland urban interface, prescribed fire could be used to improve lynx habitat over time by strategically placing fire on the landscape in lynx habitat currently lacking high horizontal cover, as fire often promotes recruitment of a high density of conifers, hardwoods and shrubs needed to support snowshoe hares. Prescribed fire as a vegetation management tool can have similar effects to timber harvest, but prescribed burning differs from harvest in that burned trees are typically left behind, leaving a biological legacy that contributes to nutrient cycling, as well as to the availability of coarse woody debris for lynx denning habitat. Prescribed fire could also be used outside of the wildland urban interface for other resource management needs, which could result in a reduction of existing snowshoe hare habitat. The Northern Rockies Lynx Management Direction restricts prescribed fire projects that reduce snowshoe hare habitat to a small list of very narrow purposes, which would limit the amount of snowshoe hare habitat affected. Any such reduction in snowshoe hare habitat would be temporary, with summer hare habitat expected to regenerate within 5 to 15 years post fire, and winter snowshoe hare habitat expected to regenerate within 16 to 40 years post fire. The Northern Rockies Lynx Management Direction caps the amount of lynx habitat that can be converted to an early stand-initiation stage by vegetation management including prescribed fire, but allows for some conversion to perpetuate the cycle of diversity by mixing young regenerating forest with mature and older multi-story forest in lynx habitat. This is consistent with desired conditions for fire and fuels management under all plan revision alternatives.

Fire suppression can affect lynx habitat by limiting the amount of stand-initiation stage snowshoe hare habitat present on the landscape, as well as through the construction of firelines or fuel breaks that could fragment habitat and inadvertently create routes that attract new human-use patterns, which could facilitate additional snow compaction in lynx habitat. Conversely, where large-scale disturbances have occurred recently, fire suppression may benefit lynx by preserving forest cover or multi-storied snowshoe hare habitat. All revised plan alternatives include a guideline to use minimum impact suppression tactics in sensitive habitat for at-risk species, which would be consistent with fire and fuels-related Northern Rockies Lynx Management Direction guidance to avoid creating new permanent travel routes for people and to avoid placing permanent firebreaks on saddles and ridges that may be important travel routes for lynx. Lynx habitat types typically have long natural fire return intervals and high fire intensity. It is generally agreed that fire suppression activities have had little impact on lynx habitat (USDI FWS 2000a).

Effects from Timber Management

Mechanical harvest of timber has the potential to affect lynx habitat in ways that can be detrimental, neutral, or even beneficial to lynx. Negative impacts to individual lynx could occur through management actions that remove, change, or reduce the amount or density of horizontal cover in boreal forest types that are naturally capable of supporting snowshoe hares. Vegetation management in areas that have no potential to support snowshoe hares, or actions designed to maintain a stand’s existing condition, would be neutral to lynx. Finally, vegetation management can benefit lynx habitat in mature forest types where understory cover is lacking. Mechanical removal (harvest) of mature trees in the overstory can stimulate conifer regeneration, which may subsequently increase browse and cover availability for snowshoe hares (Interagency Lynx Biology Team 2013).

All revised plan alternatives contain desired conditions for timber production that supports economies as well as sustaining ecosystem health by creating environments that are resistant to natural disturbances. Plan components require that mechanical harvest for purposes of timber production occur only on lands classified as suitable for timber production. Under the existing forest plans (alternative A), the area suitable for timber production includes about 17 percent of the National Forest System acres in the montane geographic areas, with only 7 percent of the Absaroka Beartooth Mountains Geographic Area, which is where core lynx habitat occurs on the Custer Gallatin National Forest. The area suitable for timber production decreases from existing under all revised plan alternatives, ranging from a low of 12 percent of the montane geographic areas and 5 percent of the Absaroka Beartooth Mountains Geographic Area under alternative D, to 14 percent of montane geographic areas and 6 percent of the Absaroka Beartooth Mountains under alternatives B and E (see tables in the Timber section for details). The area suitable for timber production includes lynx habitat as well as warmer, drier forest types that do not provide denning and foraging opportunities for lynx. Therefore, the proportion of lynx habitat within the area suitable for timber production is even less than indicated for the entire montane ecosystem and individual geographic areas. Mechanical harvest of timber could also occur on lands not suitable for timber production to address a variety of resource needs, including salvage of damaged trees, fuels management, and wildlife habitat maintenance or enhancement, among other possible resource reasons.

Timber harvest, whether for timber production, or for other resource purposes, has potential for short-term impacts to lynx, but over time, generally would be expected to provide a matrix of habitat structure required by lynx. All timber harvest proposed in lynx habitat would be subject to requirements in the Northern Rockies Lynx Management Direction. The direction contains exemptions for fuel reduction treatment in wildland urban interface, which could be achieved through timber harvest. In such cases, the intent would be to maintain the results of the treatment over time, rather than allow natural succession to regenerate snowshoe hare and lynx habitat. Therefore, fuel reduction treatment in the wildland urban interface has the greatest potential for longer-term negative effects on lynx. Again, the Northern Rockies Lynx Management Direction caps the amount of lynx habitat that can be altered for fuel reduction in the wildland urban interface. In addition to Northern Rockies Lynx Management Direction restrictions, forestwide plan components under all alternatives would require that harvest units be designed to reflect natural terrain patterns, with maximum size limits on openings created by timber harvest, and design criteria that include considerations for wildlife habitat. Mechanical harvest for timber production would be used only in areas where there is reasonable assurance of restocking (conifer regeneration), within 5 years after harvest completion, which would promote establishment of young, dense forest that could eventually provide snowshoe hare habitat when it occurs in boreal forest types.

Whether used for timber production or other resource purposes, timber harvest prescriptions fall into three main categories:

- even-aged regeneration harvest, which removes all or nearly all trees to produce openings intended to regenerate even-aged stands;
- intermediate harvest, which typically removes the majority of trees, resulting in more open stands with multiple age classes and multiple stories in the tree canopy; and
- harvest that removes generally small trees for purposes such as promoting individual tree growth, or removing ladder fuels.

Each type of harvest has the potential to affect lynx habitat when performed in boreal forest conditions. Even-aged regeneration harvest creates openings that are typically unsuitable for snowshoe hares and lynx in the short term (0-15 years after harvest), but have high potential to grow into high quality snowshoe hare and lynx habitat in the mid-term (16 to 40 years after harvest). Intermediate harvest can have similar effects, such as reducing horizontal cover for snowshoe hares and lynx in the short term, with potential to create high-quality snowshoe hare and lynx habitat in the mid- to long term by producing multi-storied stands with dense horizontal cover in the understory. Harvest such as precommercial thinning in dense, young stands and mechanical fuel reduction treatments that remove ladder fuels, typically decrease the amount of horizontal cover near the ground, reducing the amount and quality of snowshoe hare habitat, thereby impacting potential lynx foraging habitat. This third type of harvest has the greatest potential for negative effects to lynx because these methods tend to result in more open forest structure, with lower horizontal cover near the ground for longer periods of time than regeneration or intermediate harvest methods. However, these are the types of activities most constrained by the Northern Rockies Lynx Management Direction. Harvest that would reduce snowshoe hare habitat is allowed only for fuel reduction in the wildland urban interface, and is subject to a forestwide cap.

Salvage and sanitation harvest involves the removal of dead or dying trees in areas that have been affected by fire, insects and disease. Coarse woody debris such as down logs and root wads, are important elements of lynx denning habitat, and unregulated removal of dead and dying trees could reduce the availability of existing and potential future denning habitat. All alternatives include plan components that would require retention of a certain amount of coarse woody debris in vegetation treatment units. These components do not vary between revised plan alternatives. Compared to existing plans (alternative A), the plan components for coarse woody debris in the revised plan alternatives would be more ecologically relevant, as they are customized to potential vegetation types to reflect a more natural range of variation. Further, the revised plan alternatives would require retention of coarse woody debris for all vegetation management projects, not just “if available” as currently indicated under the current plans. In addition to plan components for coarse woody debris, all revised plan alternatives include plan components that would limit salvage harvest in riparian management zones, and would require retention of live, dying or dead trees in post-burn salvage units. Finally, all alternatives contain plan components for retaining snags, which are standing dead trees that could eventually contribute coarse woody debris for lynx denning habitat. Plan components for snag management do not vary between the revised plan alternatives, but would require more and generally larger snags to be left in treatment units where snags may be lacking, than required under the existing plans. Collectively, plan components in the revised plan alternatives would provide greater protection for snags and coarse woody debris than under the existing plans, and would be more consistent with the Northern Rockies Lynx Management Direction intent to maintain habitat components necessary for the conservation of lynx.

Given a variety of resource objectives and constraints, amounts and types of timber harvest predicted in the future vary by alternative (see tables in Timber section for details). Alternative D would result in the largest amount of acreage treated with timber harvest over two decades), while alternative E would have the least amount of acreage treated with timber harvest in the same timeframe. However, alternative E would focus more on timber production, meaning less acres affected, but generally larger trees removed and fewer overall trees left standing. In contrast, timber harvest under alternative D would focus more on restoration, which would mean more acres affected, but with generally smaller trees removed, leaving the larger trees to grow in order to increase the large tree component. Small trees are an important element of snowshoe hare habitat, and timber harvest that reduces snowshoe hare habitat is restricted in the Northern Rockies Lynx Management Direction. Alternative E would have the most short-term effects by creating early stand initiation stage habitat, but over time would increase the amount of stand initiation stage snowshoe hare habitat, while alternative D has better potential to increase amounts of multi-storied mature snowshoe hare habitat. Alternatives A, B and C would all have similar acreages treated by timber harvest, at intermediate levels between alternatives D and E. Regardless of purpose, timber harvest in lynx habitat and designated critical habitat would be subject to constraints of the Northern Rockies Lynx Management Direction. Generally, timber harvest may have short-term negative effects on individual lynx, with potential for longer-term benefits as treated areas regenerate. However, under all alternatives, the effects of timber harvest would be negligible compared to effects of natural disturbance processes on lynx habitat.

Effects from Land Allocations

Areas designated by authorities beyond the Forest Service, including those designated by statute such as wilderness areas, inventoried roadless areas, wilderness study areas, and wild and scenic rivers, do not vary between alternatives, and effects for these were covered above under Effects Common to All Alternatives. However, a variety of other forest plan allocations vary by alternative. Of these, the most notable for wildlife considerations include recommended wilderness, backcountry areas, and recreation emphasis areas. See the Designated Areas and Forest Plan Allocation sections for a full description of designated areas and forest plan allocations.

Recommended wilderness areas often spatially overlap with inventoried roadless areas, so all land use restrictions imposed by inventoried roadless designation would also apply to recommended wilderness areas where the two overlap (see tables in the Recommended Wilderness Area section for proportions of overlap). However, recommended wilderness areas impose additional restrictions, primarily the prohibition on construction of new mechanized and motorized use routes (roads and trails), which may be allowed under certain circumstances in inventoried roadless areas. The amount of recommended wilderness areas in the montane geographic areas varies by alternative, including nearly 34,000 acres in existing plans (see the Recommended Wilderness Area section for more detail). The largest amount of recommended wilderness in the montane geographic areas occurs in alternative D (over 675,000 acres) with the least amount in alternative E (none). Of the forest plan allocations, recommended wilderness areas have the highest level of restriction on management actions, leaving natural succession and disturbance processes as the primary change agents for lynx habitat conditions over time. Restrictions on new recreational motorized and mechanized means of transport in alternative B and all recreational motorized and mechanized means of transport in alternatives C and D would result in lower levels of disturbance due to noise and human presence. Effects to lynx resulting from human disturbance are not well understood as few studies have directly examined this aspect of lynx ecology. Available information suggests that while some lynx may be quite tolerant of human presence, it is likely that lynx exhibit a range of behavioral responses to various types of human activity, which may include heightened sensitivity to human disturbance near reproductive den sites (Interagency Lynx Biology Team 2013). Therefore, a logical conclusion is that lower disturbance levels associated with higher proportions of recommended wilderness would benefit lynx.

On the other hand, management restrictions in recommended wilderness would limit the types of vegetation management tools available to implement silvicultural prescriptions specifically designed to improve lynx habitat. Administrative use of motorized and mechanized equipment would be allowed to some degree in recommended wilderness areas for restoration purposes, including habitat improvement projects for lynx. For example, prescribed fire could be used to improve lynx habitat, but might be constrained by limited access due to prohibitions on new road construction in recommended wilderness areas. In addition, inability to pre-treat high fuel loads could affect the ability to effectively use prescribed fire for restoration purposes in recommended wilderness areas. Mechanical treatment such as selective tree removal to stimulate understory growth for the benefit of lynx, could also be limited by access considerations. Finally, although some restoration activities would be allowed in recommended wilderness areas, the combination of restrictions on certain types of equipment, limited access and potentially high fuel loads, tends to result in much higher cost per acre for restoration projects there, which may reduce the likelihood of implementing these types of projects in strategic locations, and at the appropriate scale to achieve desired results.

Backcountry area is a new forest plan allocation in lynx habitat on the Custer Gallatin National Forest, which would occur in all revised plan alternatives except alternative D, with the greatest acreage in alternative E, fewer acres in alternative C, and the least in alternative B. Backcountry areas would be maintained as generally undeveloped or lightly developed, meaning they would typically have no roads, or a few primitive roads. They may contain no trails, nonmotorized use trails only, or a combination of motorized and nonmotorized use trails, depending on the backcountry area. As with recommended wilderness, backcountry areas often spatially overlap with inventoried roadless areas, limiting certain types of use. With an emphasis on low development, the backcountry areas would have lower disturbance from noise and human disturbance than non-designated areas. However, land uses are less restricted in backcountry areas than in recommended wilderness areas. For example, temporary roads would be allowed for habitat restoration purposes in most backcountry areas, as would the use of certain types of equipment that may not be allowed in recommended wilderness areas. Like recommended wilderness areas, backcountry areas are not suitable for timber production, but timber harvest is allowed for certain purposes including restoration or habitat improvement. Vegetation management tools such as prescribed fire and timber harvest could be used for resource purposes other than lynx habitat improvement in backcountry areas. In such cases, the direction in the Northern Rockies Lynx Management Direction would still provide adequate protection for lynx habitat. In summary, backcountry areas provide a higher degree of protection from human disturbance than non-designated areas, but potentially allow for more proactive management to improve lynx habitat than recommended wilderness areas.

Recreation emphasis area forest plan allocations vary by alternative. All potential recreation emphasis areas are located in the montane geographic areas that contain mapped lynx habitat. Recreation emphasis areas currently have, and are expected to continue to receive, relatively high levels of motorized and nonmotorized recreation use, and may have a high density of recreation-related infrastructure relative to other parts of the national forest. Effects of recreation on lynx and lynx habitat are not well understood, but potential mechanisms through which recreation may affect lynx include disturbance from noise or human presence associated with recreation use, habitat loss resulting from removal of forest cover for development of permanent facilities such as ski runs, roads, campgrounds, reservoirs, or other facilities, and snow compaction, which may reduce the competitive advantage lynx have in deep snow conditions. Disturbance effects were addressed above under backcountry areas. Habitat loss can reduce prey availability, as well as produce more fragmented landscapes that could affect lynx movement patterns within or between home ranges (Interagency Lynx Biology Team 2013).

As noted previously, lynx habitat in the Greater Yellowstone Area is naturally more patchily distributed than other areas where lynx are found. Recreation emphasis areas may further fragment habitat due to higher densities of access routes and other recreation-related infrastructure than found elsewhere on the Custer Gallatin National Forest. However, recreation emphasis areas are small relative to the scale at which lynx are likely to use the landscape, and therefore unlikely to create barriers to lynx movement. Most recreation emphasis areas are adjacent to areas with land use restrictions such as wilderness, wilderness study, or inventoried roadless areas. Concentrating human use in recreation emphasis areas may serve to consolidate use and associated habitat loss or fragmentation into relatively small areas, rather than spreading out impacts through greater investments in dispersed recreation. All revised plan alternatives include a desired condition for recreation emphasis areas to provide sustainable recreation opportunities that are responsive to changing recreation demands, and a guideline to reduce the likelihood of establishing unplanned visitor use patterns, which would serve to continue the consolidation of human use and reduce potential impacts on surrounding lynx habitat from increasing human recreation use.

Since lynx and snowshoe hares share an adaptation for deep, soft snow conditions, winter recreation effects have been studied. Squires and others (2010) found no evidence that lynx avoided roads used by snowmobiles in winter. However, researchers have explored another hypothesis that human activities resulting in snow compaction (such as skiing, snowmobiling, snow-shoeing and plowing roads) could impact lynx by lending a competitive advantage to other carnivores, such as coyotes, bobcats or mountain lions, which do not travel efficiently in deep soft snow conditions. Studies and observations in northwestern Montana have shown that coyotes did not travel on, or near snowmobile routes more often than randomly expected (Kolbe et al. 2007), while others in Utah and Wyoming indicated that the presence of compacted snowmobile routes did influence winter coyote distribution (Burghardt Dowd 2010). Natural variation in snow penetrability between the different geographic areas where these studies occurred might explain the apparent contradictory results (Interagency Lynx Biology Team 2013). No comparable studies have occurred directly on the Custer Gallatin, but as part of the Greater Yellowstone Area, snow conditions (and associated lynx habitat) on the Custer Gallatin are more similar to those studied in northwestern Wyoming by Burghard and Dowd (2010) than snow conditions studied in northwest Montana by Kolbe and associates (2007), suggesting that snow compaction on the Custer Gallatin could possibly influence coyote distribution allowing for overlap with lynx habitat in winter. Even so, researchers in both locations also examined prey associations of coyotes and lynx, finding little if any dietary overlap between the species, indicating low levels of competition for prey (Interagency Lynx Biology Team 2013).

The revised plan alternatives have identified three winter recreation emphasis areas that, because of the expected high levels of concentrated winter use, would result in substantial areas of snow compaction within and near lynx habitat. The winter recreation emphasis areas that could impact lynx habitat include Cooke City (in alternatives B, C and E), Hebgen (alternatives B, C and E) and Bridger (alternative E) Recreation Emphasis Areas. Winter recreation emphasis might be expected to attract additional winter use, possibly resulting in even larger areas of snow compaction than existing conditions. However, these areas are all close to population centers and areas that are currently managed, and heavily used for winter recreation. None of these forest plan allocations would occur under alternative D. However, none of the existing features that attract high levels of winter use to these areas would be removed or otherwise altered, and management would continue to focus on recreation opportunities in these areas under alternative D. In addition to the recreation emphasis areas that are specifically allocated for winter use, a number of recreation emphasis areas are allocated for year-round recreation, which could include motorized or nonmotorized winter recreation. Recreation emphasis areas tend to have better access with paved and or plowed roads than other parts of the national forest, which may serve to consolidate winter recreation use, thereby reducing potential impacts to lynx from snow compacting activities that would otherwise be dispersed over larger areas. All revised plan alternatives include a guideline to manage and rehabilitate administrative infrastructure such as temporary roads, skid trails and landings to reduce the likelihood of establishing unplanned visitor use patterns. In addition, the Northern Rockies Lynx Management Direction contains guidelines for expanding winter use areas and designated over-snow routes that would limit impacts to lynx within the winter recreation emphasis areas. In effect, forest plan allocation for recreation emphasis areas is a way to acknowledge existing and anticipated future use levels. Through incorporation of the Northern Rockies Lynx Management Direction in all alternatives, and additional plan components under revised plan alternatives with recreation emphasis area allocations, all alternatives provide tools for managing high use areas and effectively consolidating such use, which would be consistent with the intent of the Northern Rockies Lynx Management Direction for conserving lynx habitat.

Effects from Permitted Livestock Grazing

Permitted livestock grazing occurs in lynx habitat on the Custer Gallatin National Forest, although livestock are present at lower densities in the montane ecosystem geographic areas where lynx habitat is present than in the pine savanna geographic areas. The revised plan alternatives include desired conditions for livestock grazing allotments to maintain or trend toward desired ecological conditions stated for a variety of habitats, which would include boreal forest types that could support lynx, as well as important intervening types that provide connectivity between patches of lynx habitat. To this end, the revised plan alternatives would require new or revised allotment management plans to incorporate grazing practices that avoid, minimize or mitigate adverse impacts to ecosystems. Generally, livestock are not attracted to densely forested stands that provide high quality habitat for lynx and snowshoe hares, unless seeking shelter from weather. Livestock use of forested stands for shelter has little effect on the structural characteristics of lynx habitat components. However, livestock may be attracted to recently disturbed (such as burned or harvested) forests by a flush of high quality forage that often appears soon after disturbance. In such cases, livestock can delay the regeneration of dense, young forest selected by snowshoe hares, by trampling and damaging deciduous shrubs or conifer seedlings soon after they sprout. The Northern Rockies Lynx Management Direction contains guidelines to prevent such impacts, which is consistent with plan components (desired conditions) for permitted livestock grazing in the revised plan alternatives.

If not properly managed, livestock can have negative effects. The revised plan alternatives contain a number of plan components to minimize livestock impacts to riparian habitats and deciduous woodlands (such as aspen), which can function as important secondary habitat for lynx, as well as providing connectivity between patches of primary (boreal forest) habitat. These plan components would contribute to the conservation of lynx habitat. In addition to these components, alternative D includes a goal that the Custer Gallatin consider closure of vacant livestock allotments for accelerated ecological enhancement in areas of conservation need, including habitats for at-risk species such as lynx. This goal could be used to the benefit of lynx if livestock use was shown to be having detrimental effects to lynx habitat.

Effects from Energy and Minerals Management

There are three types of mineral and energy resources utilized on the Custer Gallatin National Forest: locatable minerals including commodities such as gold, silver, copper, etc., saleable minerals such as sand, stone, and gravel, and leasable minerals such as oil, gas, and other natural commodities (see Energy, Minerals and Geologic Areas of Interest section for details). Nationally, mining levels have dropped substantially from historic levels in lynx habitat, and modern mines operate under more stringent environmental protections than existed historically (Interagency Lynx Biology Team 2013). On the Custer Gallatin, more than 1 million acres (over a third of the National Forest System lands), have been formally withdrawn from mineral entry, effectively prohibiting activities related to exploration, development and production of mineral resources. To date, mineral withdrawals on the Custer Gallatin have occurred in the montane geographic areas, which is also where lynx habitat is located. At the time this analysis was written, the majority of locatable mineral operations active on the Custer Gallatin were located in the Stillwater mining complex in the Absaroka Beartooth Mountains Geographic Area. The

Stillwater Complex land allocation (see designated areas maps for alternatives B, C, and E in appendix A) contains mapped lynx habitat, and is largely within designated critical habitat for lynx.

In areas open to mineral development (not withdrawn), the General Mining Law of 1872 provides strong rights for prospecting, exploration and development of minerals on National Forest System lands, including the right to reasonable access for such purposes. Activities associated with locatable, salable or leasable mineral resources could affect lynx habitat by altering or removing native vegetation for the development of roads, mines or other related facilities. Such activities could result in temporary or permanent reductions or loss of lynx habitat, as well as long-term fragmentation of lynx habitat. Winter access to mineral or energy developments could impact lynx habitat through snow compaction if access requires plowing or grooming access routes, or if sites are accessed regularly by over the snow vehicles. The revised plan alternatives include desired conditions that energy and mineral resources are available for use, but also include plan components to manage access commensurate with the stage of operations, and further require that lands affected by energy and mineral development are reclaimed to preoperational site conditions as much as possible once mining operations are complete. The Northern Rockies Lynx Management Direction includes guidelines to minimize snow compaction related to mineral and energy management. To the extent practicable under the 1872 mining law, forestwide plan components for mineral and energy management in the revised plan alternatives are consistent with the Northern Rockies Lynx Management Direction’s intent to conserve lynx habitat.

The Stillwater mining complex area has shown high potential for mineral development, specifically its unique platinum and palladium resources. As such, the area would receive forest plan allocation to recognize such use in alternatives B, C and E. The area is used primarily for mineral development under the existing Custer and Gallatin forest plans as well (alternative A). Under these alternatives, mineral development would be expected to continue and perhaps expand, as recognized use in the Stillwater mining complex area, with associated impacts to lynx habitat as described above. Under alternative D, there would be no forest plan allocation for mining purposes, but mining operations would be expected to continue at existing levels. However, under alternative D, some of the area with minerals emphasis under alternatives B, C and E, would be allocated as recommended wilderness. Under certain circumstances, access for mineral operations would still be allowed under existing laws in recommended wilderness and other allocations that generally do not allow new road construction (see Mineral Encumbrances section for details). However, additional mitigation measures to protect resources, including location of facilities and timing of use, may be imposed on any new proposals for minerals or energy development within the recommended wilderness.

Effects from potential future mineral development across the entire national forest are difficult to determine as there is much speculation involved regarding what, when and where private mineral rights may be invoked. However, since more mitigation would likely be imposed on mineral development under certain plan allocations, alternative D has the greatest flexibility for imposing mitigation measures to minimize alteration of lynx habitat and reduce potential snow compaction, followed by alternatives C and B, with alternatives A and E being similar and least flexible for imposing mitigations.

Effects from Infrastructure Management

Forest infrastructure includes roads, trails, bridges, administrative facilities, and dams. Construction and maintenance of infrastructure can result in permanent loss of lynx habitat if it results in the removal of boreal forest cover, and can cause fragmentation of lynx habitat if large areas of non-lynx habitat are permanently altered between patches of boreal forest. While the physical presence of roads can impact lynx habitat, the use of roads by humans affects lynx in various ways depending on the size of road, combined with traffic volume and speed. Highways facilitate high volumes of high-speed traffic, which can create barriers to lynx movement if lynx choose to avoid crossing, or can result in lynx being killed if they attempt to cross. However, lynx have been known to successfully cross highways (Interagency Lynx Biology Team 2013). National Forest System roads are delineated by their associated maintenance levels. Maintenance Level 5 corresponds with roads that are usually double lane, paved routes that accommodate a higher volume and higher speeds of traffic than most forest system roads. Maintenance Level 5 roads have the greatest potential for direct impacts on lynx, but account for a very small proportion (less than 1 percent) of roads within the national forest boundary. In contrast, over 90 percent of the National Forest System roads on the Custer Gallatin are Maintenance Level 2 or 3, which are generally narrow (often single track), gravel or other natural surface that accommodate low levels of slow-moving traffic. Of these, nearly half (about 48 percent) are open for administrative use only (are not open for public use). In northwest Montana, in an area with relatively high road density (5.13 miles per square miles) Squires and others (2010) found little avoidance of gravel forest roads by lynx. There are no records of lynx mortality resulting from vehicle collision on national forest roads in the Custer Gallatin National Forest.

While the national forest roads may have little direct effect on lynx as described above, the roads can have an indirect effect in providing access routes that may result in winter snow compaction in lynx habitat. Forest roads may be plowed or groomed to provide access in winter, or they may also experience snow compaction from winter recreation use such as snowmobiling, skiing or hiking. Snow compaction may reduce the competitive advantage lynx have over other predators in winter. Also, winter routes may facilitate access for fur trappers. Trapping of lynx for fur trade is prohibited by law; however, some federally protected lynx have been incidentally caught in traps or illegally shot by hunters in Montana, although none of these incidents has occurred on the Custer Gallatin National Forest.

Under all revised plan alternatives, forestwide plan components would include desired conditions to provide a safe, efficient transportation system for public and administrative use, while imparting minimal impacts on other resources, including threatened and endangered species. To minimize impacts, the revised plan alternatives include forestwide plan components that place restrictions on road construction and administrative facilities in old growth forest and riparian areas, encourage use of technologies that reduce impacts to other resources, and facilitate removal and restoration of roads and facilities no longer needed. All revised plan alternatives contain objectives for removal of unneeded system roads; however most of the National Forest System roads identified for removal are located in the pine savanna geographic areas, rather than the montane geographic areas where lynx habitat occurs. The emphasis on forestwide plan components for infrastructure management is to protect water and riparian resources, which are important habitat elements for lynx. Restrictions on new road construction in riparian areas would limit some permanent loss of lynx habitat due to forest infrastructure construction. The forestwide plan components for infrastructure do not vary by alternative, therefore, effects to lynx would be the same under all revised plan alternatives. However, these components provide more detailed guidance, and more restrictions on construction of new roads and other facilities, than currently contained in existing plans, so the revised plan alternatives would provide slightly higher protection for lynx habitat; particularly riparian habitats that may provide denning and foraging opportunities for lynx, as well as potential travel corridors between denning and foraging habitat. Collectively, the forestwide plan components for infrastructure are complementary to, and consistent with, Northern Rockies Lynx Management Direction guidance and intent to conserve lynx habitat. Other plan components, such as designated areas and forest plan allocations, also place restrictions on new construction for roads and other infrastructure, and these areas do vary by alternative. These factors are addressed below.

Effects from the Recreation Opportunity Spectrum

The recreation opportunity spectrum is a framework that describes the different social, managerial and physical attributes of various settings across the landscape, that when combined, provide a distinct set of recreation opportunities. The recreation opportunity spectrum is consistent with designated areas and forest plan allocations, but also applies to non-designated areas of the national forest. The recreation opportunity spectrum framework identifies five distinct classes that are present to some degree on the Custer Gallatin National Forest: primitive, semi-primitive nonmotorized, semi-primitive motorized, roaded natural, and rural (see Recreation Opportunity Spectrum section for definitions and details). Generally, the primitive setting provides the most natural setting and greatest level of habitat security (free from or low human disturbance factors) for wildlife. On the other end of the spectrum, the rural setting includes the most developed settings, easy access, and proximity to human population centers, which correlates to modified natural environments and higher levels of human disturbance for wildlife. The recreation opportunity spectrum is also differentiated between summer and winter recreation settings, with generally similar activity types for both seasons.

The amount and distribution of the five recreation opportunity spectrum classes varies by season (summer versus. winter) as well as by alternative. For the montane geographic areas where lynx habitat is located, the primitive spectrum accounts for the majority of acreage both summer and winter under all alternatives. For both summer and winter, the primitive spectrum ranges from a low of 43 percent of the montane ecosystem in alternatives A and B to a high of 71 percent of the montane ecosystem under alternative D. Winter use in primitive settings may result in some snow compaction, but it generally occurs at low levels, since there are no groomed routes and generally limited access to primitive recreation opportunity spectrum settings. The relatively high levels of primitive settings in the montane ecosystem geographic areas are tied to the presence of large, designated wilderness areas (Absaroka-Beartooth and Lee Metcalf). The bump in primitive settings between alternatives is due to different configurations for recommended wilderness.

The montane ecosystem geographic areas also have relatively high proportions of semi-primitive nonmotorized settings, which are similar to primitive settings, but allow for the inclusion of nonmotorized mechanized recreation such as mountain biking, and may include rustic facilities such as trail signs and foot bridges. Winter semi-primitive nonmotorized settings allows for Nordic and backcountry skiing, and other nonmotorized winter use. With few exceptions, winter trails in semi-primitive nonmotorized settings are not groomed. Under all alternatives, the winter recreation opportunity spectrum settings of primitive and semi-primitive nonmotorized combined account for roughly two-thirds of the montane ecosystem geographic areas. For summer, combined primitive with semi-primitive nonmotorized settings would range from a low of 67 percent of the montane ecosystem under the current plans to a high of 75 percent of the montane ecosystem under alternative D. The settings of primitive and semi-primitive nonmotorized, along with underlying designated area and land allocation plan components, provide lynx habitat in which natural disturbance processes dictate habitat conditions, and habitat fragmentation due to human development and use (summer and winter) is relatively low.

The other three recreation opportunity spectrum classes, semi-primitive motorized, roaded natural, and rural, are generally more developed, with higher access levels, which often facilitate higher densities of human presence, as motorized access allows people to travel further faster. Motorized equipment often emits a loud noise, which can be detected by wildlife at greater distances than nonmotorized use. The vast majority of National Forest System roads are narrow, gravel surface routes that support generally low speed travel (less than 35 miles per hour). Squires and others (2008; 2010) found that lynx did not avoid gravel forest roads, but reproductive den sites were located further from roads. Trails are typically narrow (single or double track) routes with native surface, also suitable for generally low speed traffic. The Lynx Conservation Assessment and Strategy found no information to suggest that trails have negative impacts on lynx (Interagency Lynx Biology Team 2013). Collectively, the motorized settings represent a fairly low proportion of the montane geographic areas in summer and winter, ranging from a low of about 25 percent under alternative D (summer and winter), to a high of about 34 percent under alternatives A and E in winter.

The recreation opportunity spectrum classes not only determine what types of recreational uses would be allowed in an area, but also reflect the types of management activities could occur. Generally, high proportions of nonmotorized classes (primitive and semi-primitive) in the montane geographic areas indicate that under all alternatives, at least two-thirds of the collective montane geographic areas (where lynx habitat is located) have land use restrictions (such as designated areas or other plan components) that limit the amount of motorized activity during summer and winter; from vegetation management and other administrative functions, to recreational use by the public. As a result, under all alternatives, lynx habitat conditions on the Custer Gallatin would largely be driven by natural succession and disturbance processes, with large areas relatively free from human-caused snow compacting activities such as road or trail grooming.

Effects from Ski Area Management

Permitted ski resorts provide opportunities for concentrated winter recreation, resulting in large areas of snow compaction that could affect lynx habitat. All revised plan alternatives contain forestwide plan components to minimize resource impacts from new or expanding ski areas, which are complementary to, and consistent with the Northern Rockies Lynx Management Direction guidelines for ski areas in lynx habitat.

Cumulative Effects

The Canada lynx is protected as a threatened species with designated critical habitat, requiring conservation measures by all land management agencies resulting in a collective suite of management plans geared toward conserving lynx and designated critical habitat for the species. All national forests with Canada lynx habitat in Forest Service Regions covering parts of Montana, Idaho and Wyoming formally adopted the Northern Rockies Lynx Management Direction through forest plan amendments (USDA FS 2007a) and are still operating under this direction. Lynx management direction focuses on protecting the key components of lynx habitat and primary constituent elements of designated critical habitat for lynx. Therefore, cumulative effects for Canada lynx and designated critical habitat for lynx would result in consistent management across Greater Yellowstone Ecosystem national forests, as well as national forests in northwestern Montana that provide connectivity with source populations in Canada. The general management plan for Yellowstone National Park calls for preserving natural resources, including natural vegetation, landscapes and disturbance processes, resulting in large proportions of backcountry managed similarly to wilderness areas on adjacent Custer Gallatin lands. The cumulative effects are large, contiguous areas of low human impact for lynx. Bureau of Land Management lands near lynx habitat on the Custer Gallatin are managed by the Dillon (2006 plan), Butte (2009 plan) and Billings (2015 plan) field offices. These plans follow guidance from the Lynx Conservation Assessment and Strategy, (Ruediger et al. 2000), Interagency Lynx Biology Team 2013), which lead to management consistent with national forest direction contained in the Northern Rockies Lynx Management Direction.

The Montana Department of Natural Resources and Conservation has a Habitat Conservation Plan (MTDNRC 2010) for management of forested state trust lands. The Habitat Conservation Plan commits to protecting lynx habitat by minimizing impacts of forest management on important habitat elements for lynx and prey species, with a goal to support federal lynx conservation efforts, in a manner consistent with the Northern Rockies Lynx Management Direction. In addition, Montana Fish Wildlife and Parks developed a State Wildlife Action Plan (Montana FWP 2015), which identifies habitat community types, focal areas, and wildlife species that warrant conservation attention. The State Wildlife Action Plan does not identify Canada lynx as a species of greatest conservation need, but does identify conifer-dominated forest and riparian areas as community types of greatest conservation need in the ecoregions that support lynx, which is consistent with Northern Rockies Lynx Management Direction habitat management provisions. Since the lynx was listed as threatened, Montana Fish, Wildlife and Parks has revised trapping regulations to minimize the potential for lynx to get caught in traps set for other species.

Conclusion

The purpose of the Northern Rockies Lynx Management Direction was to incorporate management direction into forest plans that will conserve lynx habitat and promote recovery by reducing or eliminating negative effects of land management activities on National Forest System lands. At the same time, the Northern Rockies Lynx Management Direction was designed to complement the multiple-use directive for the Forest Service. Implementing the Direction benefits lynx under all alternatives by incorporating protective measures to maintain, as well as proactive measures to improve or restore lynx habitat. Additional plan components for wildlife and vegetation management in the revised plan alternatives are complementary to the Northern Rockies Lynx Management Direction measures, and would promote more strategic planning, timing and design of projects that could improve overall habitat conditions for lynx in a more affirmative manner than the more general plan direction provided under the current plans.

All alternatives contain plan components that specifically address the primary constituent elements of designated critical habitat for lynx, including habitat management standards that limit impacts to snowshoe hare habitat (element 1a), guidelines that limit snow compacting activities (element 1b), guidelines for providing well-distributed denning habitat (element 1c), and standards for maintaining habitat connectivity within and between lynx analysis units, which includes management of matrix habitat (element 1d), so as not to create barriers or impede lynx movement. As with lynx habitat in general, all revised plan alternatives include additional components for managing vegetation within the natural range of variation, management of snags and coarse woody debris, protection of riparian areas, and limiting snow compaction that go further toward lynx conservation than the current plans.

Grizzly Bear (*Ursus arctos*)

Grizzly bears on the Custer Gallatin National Forest are part of the Greater Yellowstone Ecosystem population that occurs in parts of Montana, Idaho and Wyoming. In 1975, the grizzly bear was listed as a threatened species under the Endangered Species Act of 1973 (as amended) in the lower 48 states. The U.S. Fish and Wildlife Service identified Greater Yellowstone Ecosystem grizzlies as a distinct population segment, and delisted (removed from the endangered species list) the distinct population segment in July 2017.[14] However, a September 2018 District Court ruling vacated the Fish and Wildlife Service delisting rule, restoring Endangered Species Act protection for the Yellowstone grizzly bear population. The Greater Yellowstone grizzly bear population met demographic recovery targets by 1998, and has generally met or exceeded most recovery targets since. As a result, Federal and State agencies developed a conservation strategy for managing Yellowstone grizzlies in 2003, which was updated in 2007, and again in 2016 (Yellowstone Ecosystem Subcommittee 2016). The conservation strategy was developed by an interagency team consisting of representatives from the U.S. Fish and Wildlife Service, Interagency Grizzly Bear Study Team, National Park Service, U.S. Forest Service, and wildlife management agencies from Montana, Idaho, and Wyoming. This team brought a wealth of knowledge and experience to the table, and developed the conservation strategy using this combined expertise, as well as drawing upon the best available scientific research and literature relative to grizzly bear management. The conservation strategy identifies secure habitat, developed sites, livestock grazing allotments, and key food sources as the habitat elements most likely to influence grizzly bear persistence in the Greater Yellowstone Ecosystem.

At the time of this analysis, the Greater Yellowstone Ecosystem grizzly bear population was stable to increasing, with a total population estimate of 718 grizzly bears in 2017 (Van Manen et al. 2018). With no evidence of a population decline, but rather a slowing of the rate of population growth in recent years, it may be that the Greater Yellowstone Ecosystem grizzly bear population is nearing carrying capacity (van Manen et al. 2013). Although there is no estimate of the number of grizzly bears currently using portions of the Custer Gallatin National Forest, grizzly bears are present and well distributed in the Madison, Henrys Lake, and Gallatin and Absaroka Beartooth Geographic Areas, and currently occupy most of the suitable habitat within those geographic areas (see figure 33 for current grizzly bear distribution in the Greater Yellowstone Ecosystem).

Grizzly bears are habitat generalists that employ an opportunistic, omnivorous foraging strategy by utilizing a wide range of plant and animal food source. (Gunther et al. 2014). Although grizzly bears in the Greater Yellowstone Ecosystem exhibit a high level of dietary variation, four key food groups have been identified that provide concentrations of proteins and fats that are essential sources of energy and nutrients for bears. These include ungulate biomass (obtained through direct predation as well as scavenging on carcasses), spawning cutthroat trout, whitebark pine seeds, and army cutworm moths (*Euxoa auxillaris*) (Schwartz et al. 2010, van Manen et al. 2015, Costello et al. 2016). Of these key food sources, only ungulate biomass and whitebark pin, are known to be important food sources for bears on the Custer Gallatin National Forest.

Analysis Area

There are a number of spatial scales relevant to grizzly bear use of the plan area. The Greater Yellowstone Ecosystem for grizzly bears covers parts of Montana, Idaho and Wyoming surrounding Yellowstone and Grand Teton National Parks. The Greater Yellowstone Ecosystem includes parts of five national forests, including the Custer Gallatin. The Grizzly Bear Recovery Zone (also referred to as the Primary Conservation Area) is at the core of the Greater Yellowstone Ecosystem. The recovery zone is

[14] USDI FR 80(82) 2017

about 6 million acres, with just over 1 million acres inside the Custer Gallatin boundary. Inside the recovery zone, bear management units were delineated to facilitate the assessment of habitat characteristics and recovery objectives. Bear management units represent the spatial scale of the lifetime home range of a female grizzly bear in the Greater Yellowstone Ecosystem. Bear management units are further divided into subunits, which provide additional landscape resolution to account for seasonal differences in grizzly bear use patterns within a bear management unit (USDI FWS 2016a). The Custer Gallatin intersects 9 of the 18 bear management units, and 14 of 40 subunits in the recovery zone. Bear management units and subunits on the Custer Gallatin average about 482 and 217 square miles in size respectively. Outside the recovery zone, bear analysis units were developed to provide consistent analysis units for monitoring changes to grizzly bear habitat, and are roughly the size of bear management subunits (Schwartz et al. 2009a). Eleven bear analysis units are monitored for the Custer Gallatin. Of these, eight are contiguous with the recovery zone and are located in the Absaroka Beartooth and Madison, Henrys Lake, and Gallatin Geographic Areas. Three additional bear analysis units encompass isolated mountain ranges in the Bridger, Bangtail and Crazy Mountains and Pryor Mountains Geographic Areas. At the time of this analysis, the grizzly bear distribution area (where grizzly bears are known to occur) covered nearly all of the Absaroka Beartooth and Madison, Henrys Lake, and Gallatin Geographic Areas on the Custer Gallatin. For analysis purposes, the term “grizzly bear distribution area” refers to the Absaroka Beartooth and Madison, Henrys Lake, and Gallatin Geographic Areas combined. Roughly, 44 percent of the grizzly bear distribution area is inside the recovery zone. This analysis considers effects at the ecosystem, recovery zone, bear management unit, bear analysis unit, or geographic area scale depending on the particular issue. The Ashland and Sioux Geographic Areas are outside the analysis area for grizzly bears.

Affected Environment (Existing Conditions)

The U.S. Fish and Wildlife Service identified over 11 million acres of suitable habitat for grizzly bears in the Greater Yellowstone Ecosystem (USDI FWS 2016a). Notably, the Custer Gallatin National Forest administers nearly 20 percent of the total suitable habitat, and roughly 17 percent of the recovery zone. Approximately 78 percent of the Custer Gallatin portion of the recovery zone is within federally designated areas such as wilderness, wilderness study area, and inventoried roadless areas that contain restrictions on land uses. Outside the recovery zone, roughly 70 percent of the current grizzly bear distribution area within the Custer Gallatin forest boundary falls within these same designated areas with land use restrictions. Grizzly bear distribution has been expanding on the Custer Gallatin since the original plans were implemented in the mid-1980s. Current distribution covers nearly all of the suitable habitat within the Absaroka Beartooth and Madison, Henrys Lake, and Gallatin Geographic Areas on the national forest (see figure 32 and figure 33). The most current data (van Manen et al. 2018) showed reproductive females with cubs of the year were present the past six consecutive years in 7 of the 9 bear management units intersecting the Custer Gallatin. The other 2 bear management units had females with young present for the past 5 consecutive years.

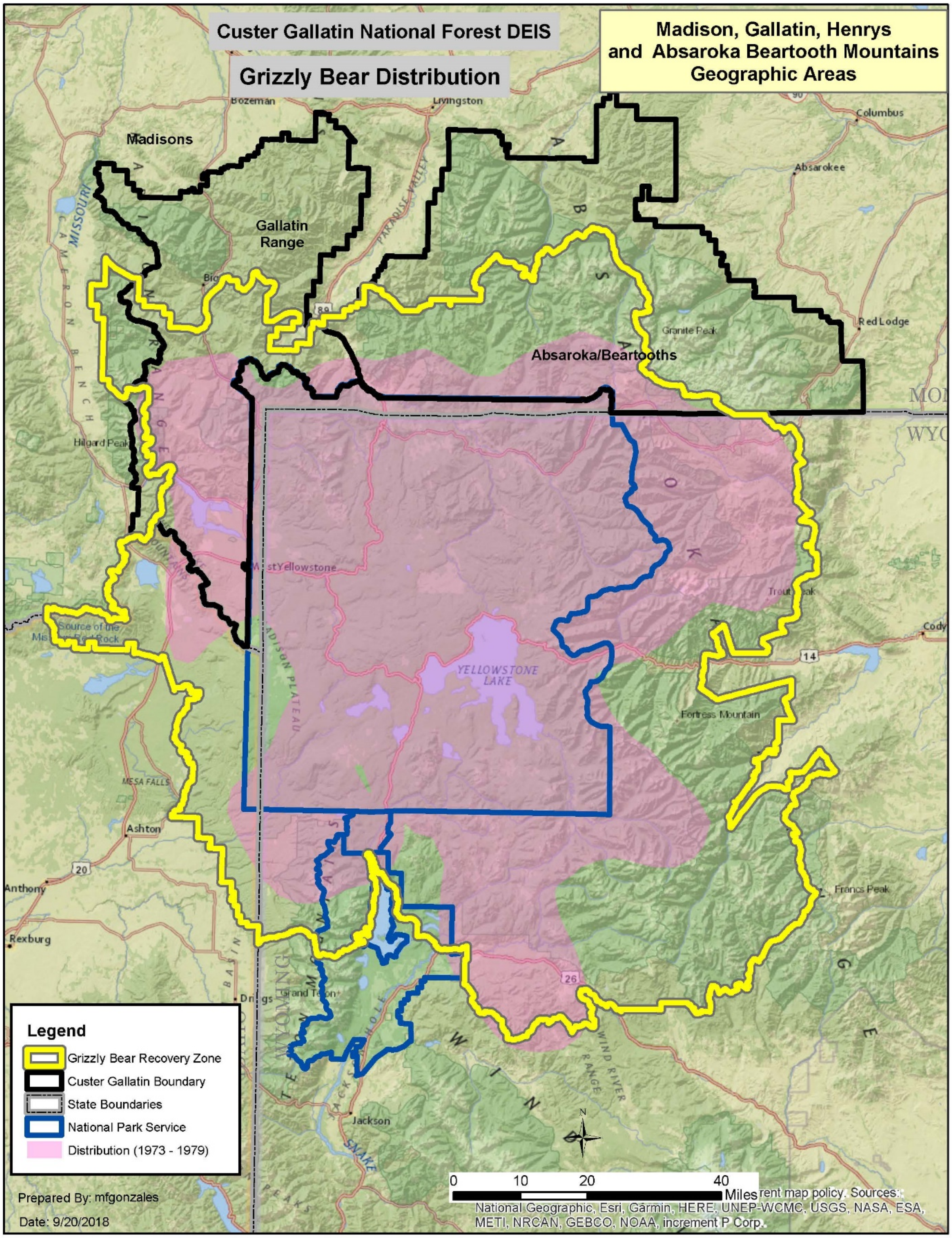

Figure 32. Grizzly bear distribution, 1970s

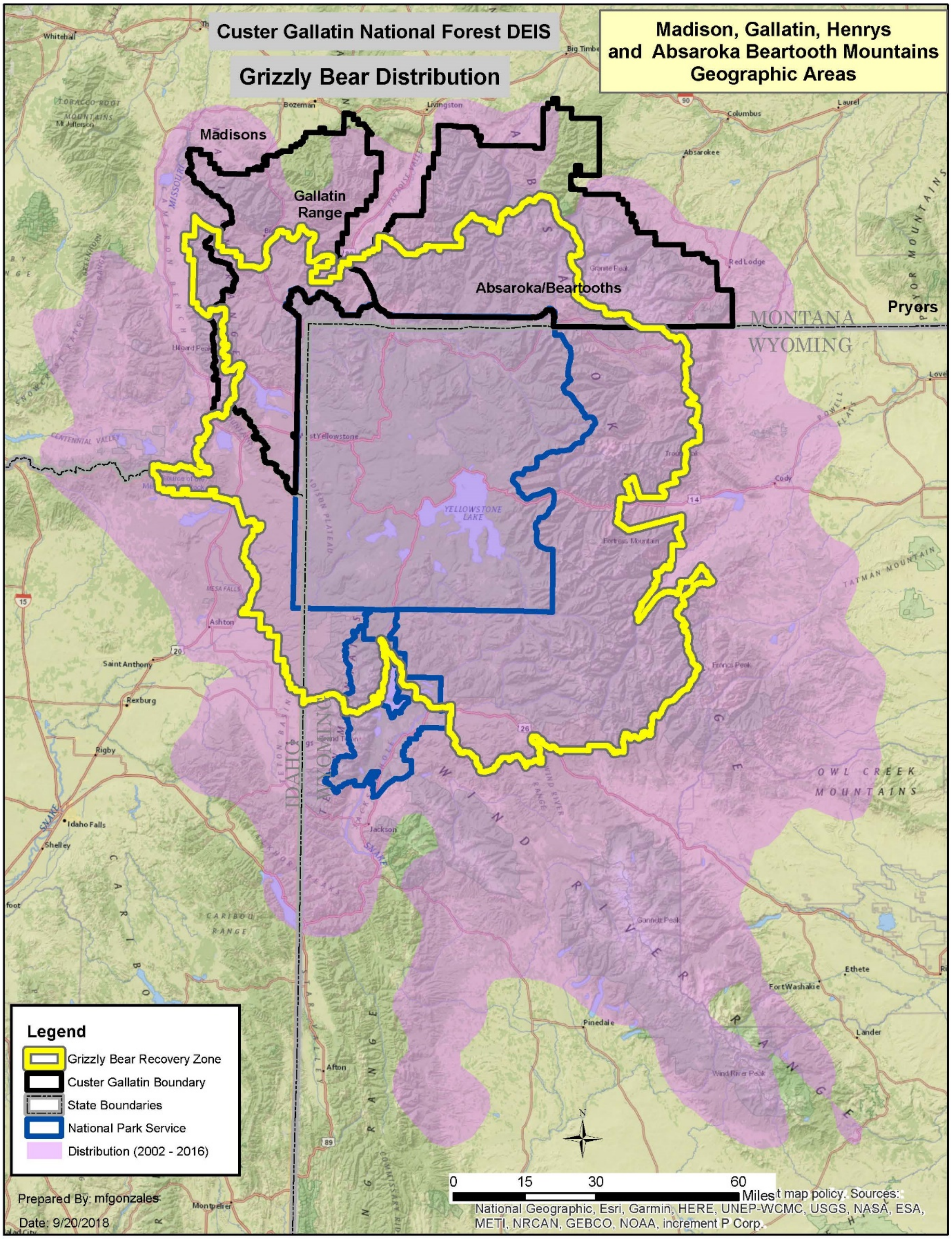

Figure 33. Current grizzly bear distribution

Availability of key food sources (ungulate biomass and whitebark pine) varies spatially and temporally across the Custer Gallatin National Forest. Ungulate biomass is readily available within the plan area, due to the presence of large herds of elk (*Cervus elaphus*), which are well distributed across the national forest, as well as mule deer (*Odocoileus hemionus*) and moose (*Alces alces*), which are less abundant than elk, but still well distributed. Bison (*Bison bison*) are also present in areas near Gardiner and West Yellowstone, whereas white-tailed deer (*Odocoileus virginianus*) and pronghorn antelope (*Antilocapra americana*) generally occur at lower elevations across the Custer Gallatin relative to grizzly bear use areas. Grizzly bears obtain ungulate biomass from scavenging carcasses, primarily on winter ranges, as well as direct predation, generally on calves and fawns. They also obtain ungulate carcasses by taking fresh kills from other predators such as wolves and mountain lions. Grizzly bears are also known to use ungulate biomass left by big game hunters in the form of gut piles or hunter-wounded animals that are not retrieved. Occasionally, grizzly bears claim entire carcasses of big game animals killed by hunters, which can lead to bear-human conflicts that may result in injury or death of either bears or humans (Ebinger et al. 2016).

Whitebark pine is a masting tree species that is cyclic, producing a large seed crop every 2 to 3 years, (Schwartz et al. 2014b). The seeds of whitebark pine are large relative to other tree species, and when abundant, provide a highly valuable food source for grizzly bears. Whitebark pine seeds mature late summer to fall. Consequently, this food is most commonly consumed by bears in September and October. Since whitebark pine grows at high elevations (roughly at or above 8,200 feet) and in fairly remote environments, it typically occurs in areas that are relatively secure from human influence. However, whitebark pine has been notably impacted within the Greater Yellowstone Ecosystem, including on the Custer Gallatin National Forest in recent years, primarily due to infestation by mountain pine beetle and, to a lesser degree, from invasion of an exotic fungus that causes white pine blister rust. Fortunately, there is evidence that whitebark pine mortality levels may be diminishing (Schwartz et al. 2014b). Climate change has had a role in recent whitebark pine mortality (Hansen et al. 2018). Some climate models have predicted continued declines in whitebark pine distribution over the next half century, although due to the relatively high elevation, range reductions may be less evident in the Greater Yellowstone Ecosystem compared to other ecosystems at lower elevations (van Manen et al. 2013). More detailed information about whitebark pine, including status, distribution, threats, and predicted future condition, can be found in the Terrestrial Vegetation and At-Risk Plant Species sections.

Although ungulate biomass and whitebark pine are of high importance to grizzly bears, these food sources are not evenly available on a spatial or temporal scale; that is, not all high-calorie, energy-rich food sources are available in all areas, or of sufficient or predictable quantity to support all grizzly bears across the Greater Yellowstone Ecosystem from year to year. The same is true for the Custer Gallatin portion of the Greater Yellowstone Ecosystem, as ungulate populations ebb and flow, weather influences the amount and distribution of winter kill, and whitebark pine seed production fluctuates from year to year. That is why the highly adaptable foraging strategy of grizzly bears serves the species so well. In geographic areas or during times of low availability of these key food sources, grizzly bears shift their attention to a wide range of alternate food sources that are of lower caloric value, but tend to be more readily available across the landscape, (Gunther et al. 2014). The broad diversity of habitat types across the Greater Yellowstone Ecosystem provides a wide variety of alternate food for bears to supplement their diet when key foods are less available, or unavailable. Refer to the Terrestrial Vegetation section for details on vegetation diversity on the Custer Gallatin National Forest.

Gunther and associates (Gunther et al. 2014) documented 266 species of plant, animal, fungi, algae and soil consumed by grizzly bears in the Greater Yellowstone Ecosystem. Some of these items were incidental, and believed to be consumed through exploratory behavior or accidentally during consumption of other foods. . The most common food items found in the grizzly bear's diet include grasses, ants (*Formicidae* spp), whitebark pine seeds, clover (*Trifolium* spp.), and dandelion (*Taraxacum* spp.),all of which are widely distributed across the Custer Gallatin Forest. Although berries occur in the Greater Yellowstone Ecosystem grizzly bear diet (ibid., Costello et al. 2016), the Greater Yellowstone Ecosystem differs from other grizzly bear ecosystems because of the lower proportion of berry-producing shrubs and relatively large populations of wild ungulates (Ebinger et al. 2016). This condition is reflective of the Custer Gallatin as well. Climate change has the potential to affect vegetation, hydrology, fire regimes and insect populations, which in turn could influence the quantity, distribution, and elevational presence of important plant and animal food sources for grizzly bears. Such changes may reduce or even eliminate the availability of some food sources, while other sources may increase, or be unaffected. Climate change could affect species composition if new species move into the area or existing species are lost (Gunther et al. 2014). Due to a high level of dietary plasticity, habitat generalists like grizzly bears tend to fare better in response to changing conditions than do habitat specialists (Costello et al. 2014).

Grizzly bears spend most of the winter in dens as a strategy to reserve energy in times of low food availability. Cubs are born during the winter denning period, placing additional energetic demands on reproductive females (Podruzny et al. 2002). Grizzly bear dens on the Custer Gallatin tend to be located at relatively high elevations, often on north-facing slopes to help maintain stable temperature and humidity conditions with a thick insulating layer of snow. Some scientists have noted a potential concern over warming temperatures associated with climate change impacting the winter denning habits of grizzly bears, and associated potential for increased grizzly bear-human conflicts if bears spend less time in dens (Cross and Servheen 2010). Over 1 million acres within the grizzly bear distribution area on the Custer Gallatin are at elevations at or above 8,200 feet, which not only provides abundant denning habitat for grizzly bears, but also at high elevations where climate change is expected to have less notable impacts. Much of this habitat is in wilderness or other areas where winter access for humans is limited.

The Interagency Grizzly Bear Committee recognized the impacts of human access on grizzly bear habitat security. Specifically, motorized vehicle access has been shown to increase human interaction with bears and potentially increase associated grizzly bear mortality risk, increase grizzly bear displacement from important habitats, increase bear habituation to human presence and reduce habitat security. Secure areas are a major component of grizzly bear habitat because they provide opportunities for bears to meet energetic needs with low potential for disturbance from human intrusions (USDI FWS 2016a). Secure habitat for Greater Yellowstone Ecosystem grizzly bears is defined as those areas at least 10 acres in size that are at least 0.3 miles away from open or gated motorized access routes, (Schwartz et al. 2010, van Manen et al. 2013, Costello et al. 2014, Yellowstone Ecosystem Subcommittee 2016).

Secure habitat is calculated using a suite of GIS geospatial tools collectively referred to as the Greater Yellowstone Ecosystem Motorized Access Model (USDI FWS 2017), using a database of linear motorized access routes (roads and trails) developed by each administrative unit in the Greater Yellowstone Ecosystem, which are then compiled and maintained by the Greater Yellowstone Ecosystem Grizzly Bear Database Coordinator. While the Greater Yellowstone Ecosystem access model is the best available tool for measuring and monitoring changes in the proportion of secure habitat over time, like all models, it is based on a set of assumptions, and outputs are only as accurate as the data fed into the model. Model and data accuracy have improved over time, but errors are still occasionally found. Corrections to the database are often due to errors of omission (for example, roads or motorized trails that existed in 1998, but were not included in original mapping). The conservation strategy specifies procedures for making corrections to the database (Yellowstone Ecosystem Subcommittee 2016). Due to model and database corrections and updates, 1998 baseline numbers can change. Examples of such changes can be found in the 2016 annual report of the Interagency Grizzly Bear Study Team, Appendix A: 2016 Grizzly Bear Habitat Monitoring Report (Van Manen et al. 2017).

Within the Greater Yellowstone Ecosystem recovery zone, secure habitat levels generally are high, averaging about 87 percent over the entire recovery zone. Secure habitat is also generally high for individual bear management subunits, but ranges from a low of 46 percent secure to a high of 100 percent secure. Subunits that fall within the Custer Gallatin National Forest boundary are within that range, with a low of 51.8 percent secure to a high of 99.6 percent (van Manen et al. 2018). Secure habitat is monitored by bear management subunits because subunits are delineated based on features that are biologically meaningful to bears. Therefore, subunits tend to overlap administrative boundaries, as is the case on the Custer Gallatin (figure 34).

Figure 34. Grizzly bear management units and subunits

Of the 14 bear management subunits that fall within the Custer Gallatin boundary, only one, Boulder/Slough 1, is entirely within the plan area; all others are shared with at least one other administrative unit (other national forest, Yellowstone National Park, or both). Considering only the Custer Gallatin portion of subunits, the area inside the recovery zone on the Custer Gallatin is roughly 79 percent secure.

Table 59 shows secure habitat by bear management subunit for the Custer Gallatin National Forest in 1998 and in 2017 (most current). The year 1998 is used as a baseline for measuring secure habitat because habitat conditions leading up to that time provided an environment that resulted in substantial growth of the Yellowstone grizzly bear population and subsequent achievement of all demographic recovery targets by 1998 (Yellowstone Ecosystem Subcommittee 2016). Secure habitat levels have increased in all but two subunits since 1998, with notable increases in the three subunits identified for improvement over 1998 baseline levels: Gallatin 3, Henrys Lake 2 and Madison 2. In addition, substantial increases in secure habitat have resulted from implementation of Travel Management Plans in the Hilgard and Madison 1 subunits.

Table 59. Secure habitat for Custer Gallatin Bear Management Subunits, 1998 and 2017

Bear Management Subunit Name and Number	Geographic Area	Size Square Miles	Percent Secure 1998 (new baseline)*	Percent Secure 2017	Change since 1998
Boulder/Slough 1	Absaroka Beartooth	282	96.6	96.6	0.0
Boulder/Slough 2	Absaroka Beartooth	232	97.7	97.7	0.0
Crandall Sunlight 1	Absaroka Beartooth	130	81.1	81.9	+0.8
Crandall Sunlight 2	Absaroka Beartooth	316	82.3	82.7	+0.4
Gallatin 3*	Madison, Henrys Lake, and Gallatin	218	55.2 (70.7)	72.5	+17.3
Hellroaring/Bear 1	Absaroka Beartooth	185	77.0	80.4	+3.4
Hellroaring/Bear 2	Absaroka Beartooth	229	99.5	99.6	+0.1
Henrys Lake 2*	Madison, Henrys Lake, and Gallatin	140	45.7 (51.7)	51.8	+6.1
Hilgard 1	Madison, Henrys Lake, and Gallatin	201	69.8	83.1	+13.3
Hilgard 2	Madison, Henrys Lake, and Gallatin	141	71.4	80.2	+8.8
Lamar 1	Absaroka Beartooth	300	89.4	89.9	+0.5
Madison 1	Madison, Henrys Lake, and Gallatin	228	71.5	80.7	+9.2
Madison 2*	Madison, Henrys Lake, and Gallatin	149	66.5 (67.5)	67.5	+1.0
Plateau 1	Madison, Henrys Lake, and Gallatin	286	68.8	70.6	+1.8

*New baseline established with implementation of Gallatin Forest Travel Management Plan

Grizzly bears are known to frequent suitable habitat outside the recovery zone as well. Areas outside the recovery zone are important to bears in that they allow for population expansion, and provide additional habitat for ecological resiliency, which presents options for grizzly bear responses to changing environmental conditions. Outside the recovery zone, secure habitat is monitored by bear analysis units.

Unlike bear management subunits, the bear analysis units on the Custer Gallatin are wholly within the national forest boundary (not shared with other administrative units). In 2016 (most recent reported timeframe) secure habitat averaged about 70.7 percent across all bear analysis areas on the Custer Gallatin, which is about a 5 percent increase since 2008, the first year there was a reliable dataset for motorized access routes outside the recovery zone (van Manen et al. 2017). Table 60 shows secure habitat by bear analysis unit for the years 2008 and 2016.

Table 60. Secure habitat in Custer Gallatin Bear Analysis Units in 2008 and 2016

Bear Analysis Unit	Geographic Area	Size Square Miles	Percent Secure 2008	Percent Secure 2016	Change
Boulder	Absaroka Beartooth	228	64.8	69.7	+4.9
Bozeman	Madison, Henrys Lake, and Gallatin	271	45.6	59.4	+13.7
Bridger	Bridger, Bangtail and Crazy Mountains	236	28.3	38.4	+10.1
Cooke City	Absaroka Beartooth	69	99.6	99.6	0.0
Crazy	Bridger, Bangtail and Crazy Mountains	255	57.2	66.9	+9.7
Gallatin	Madison, Henrys Lake, and Gallatin	415	52.3	59.6	+7.3
Mill Creek	Absaroka Beartooth	312	82.3	83.8	+1.5
Pryor Mountains	Pryor Mountains	122	38.8	38.8	0.0
Quake Lake	Madison, Henrys Lake, and Gallatin	66	85.0	92.1	+7.1
Rock Creek	Absaroka Beartooth	237	83.8	83.8	0.0
Stillwater	Absaroka Beartooth	405	85.3	85.5	+0.2

Roads and trails, both inside and outside of the recovery zone, are subject to direction contained in the 2006 Gallatin Forest Travel Management Plan and the 2008 Beartooth Ranger District Travel Management Plan. Increases in secure habitat over time, as shown in table 59 and table 60 above, are largely due to implementation of these travel management plans.

Forest plan geographic areas represent portions of the Custer Gallatin that have unique ecological characteristics, and are also places with which visitors are familiar and can easily identify. Grizzly bears are present in the Absaroka Beartooth and Madison, Henrys Lake, and Gallatin Geographic Areas, and these geographic areas are basically coincident with the current distribution area for grizzly bears on the national forest. The Absaroka Beartooth and Madison, Henrys Lake, and Gallatin Geographic Areas contain suitable habitat, are within the demographic monitoring area for Yellowstone grizzly bears, and also contain portions of the recovery zone. The Bridger, Bangtail and Crazy Mountains Geographic Area is not currently occupied by grizzlies, and is outside of the Greater Yellowstone Ecosystem grizzly bear distinct population segment (USDI FWS 2016a). However, the Bridger, Bangtail and Crazy Mountains Geographic Area has good potential to provide habitat connectivity for grizzly bears to move between the Greater Yellowstone Ecosystem and the Northern Continental Divide Ecosystem. These three geographic areas are where grizzly bears are present today, where they have the best opportunities for reproduction and survival in the future, and where they may find habitat connectivity suitable for movement between existing grizzly bear ecosystems to promote genetic diversity. Currently, these geographic areas average about 73 percent secure habitat. Table 61 and below show proportions and distribution of secure habitat for grizzly bears by geographic area.

Table 61. Secure habitat in Custer Gallatin montane geographic areas

Geographic Area	Size in Square Miles	Percent Secure as of 2017
Absaroka Beartooth Mountains	2,167	86.2
Madison, Henrys Lake, Gallatin Mountains	1,488	62.2
Bridger, Bangtail, Crazy Mountains	491	53.7

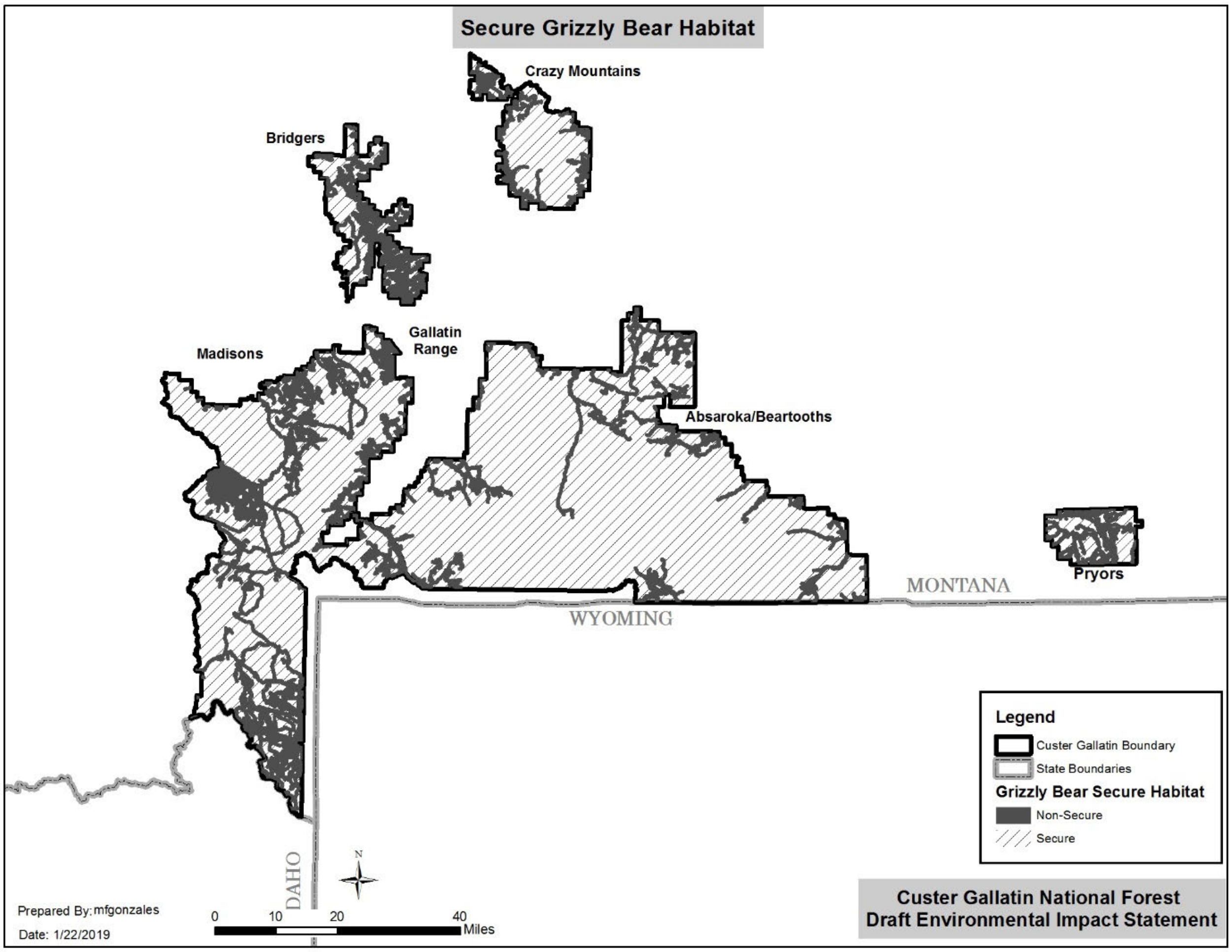

Figure 35. Grizzly bear secure habitat on the Custer Gallatin National Forest

In addition to secure habitat related to motorized human access, the other major human activities that affect grizzly bears and their habitat include permanent developments (aside from roads and trails) and domestic livestock grazing. These types of land uses have historically been associated with human-bear conflicts that result in grizzly bear mortalities, primarily due to the presence of attractants such as human food, pet food, livestock feed, garbage, animals or carcasses that draw bears into areas or situations where they are removed either through management actions or defense of life or property. All geographic areas within the montane ecosystem are under a special order that requires food and other human-related attractants to be stored so that they are unavailable to bears.

Like for secure habitat, the year 1998 is used as a baseline for monitoring the number, distribution and impacts associated with developed sites and permitted livestock grazing inside the recovery zone. Developed sites include areas on National Forest System lands that have permanent structures and facilities intended to accommodate public recreational use or administrative needs. Examples include, but are not limited to campgrounds, picnic areas, trailheads, ski areas, and rental cabins. At the time of this analysis, the number of developed sites inside the recovery zone on the Custer Gallatin had dropped from 184 in 1998 to 178. Visitor use in the Greater Yellowstone Ecosystem has increased markedly in recent years, including areas of the Custer Gallatin National Forest. Increased use that is not properly managed can have negative impacts on resources. Accordingly, the Conservation Strategy proposed a multi-agency review of the 1998 baseline for developed sites, to identify possible solutions for visitor overflow at existing sites in order to address administrative concerns in a manner that does not threaten grizzly bear habitat, and results in minimal departure from the 1998 baseline (Yellowstone Ecosystem Subcommittee 2016, van Manen et al. 2018).

Domestic livestock allotments inside the recovery zone have also declined from 39 in 1998 to 19 in 2018. This reduction included the permanent elimination of two active and four vacant sheep allotments, so there are currently no sheep allotments on the Custer Gallatin National Forest, inside or outside the recovery zone. There have been very few human-caused grizzly bear mortalities associated with developed sites on the Custer Gallatin National Forest in recent years. While there have been a few livestock (cattle) depredations attributed to grizzly bears on the Custer Gallatin in recent years, they have been isolated incidents that neither led to recurring conflicts nor resulted in grizzly bear mortalities (van Manen et al. 2018).

Since the Custer Gallatin covers much of the northern portion of the Greater Yellowstone Ecosystem for grizzly bears, it is important in terms of providing habitat connectivity to facilitate grizzly bear movement between the Greater Yellowstone Ecosystem and other grizzly bear ecosystems to the north, to promote genetic connectivity among grizzly bear populations in the continental U.S. As mentioned previously, the Bridger, Bangtail and Crazy Mountains Geographic Area has good potential to provide habitat connectivity for grizzly bear movement. As such, part of this geographic area, the Bridger/Bangtail Range, is identified in the Northern Continental Divide Ecosystem Grizzly Bear Conservation Strategy (Northern Continental Divide Ecosystem Subcommittee 2018) as Management Zone 2, which indicates areas to be managed for opportunistic movement of grizzly bears between ecosystems. The Bridger Mountain Range has large patches of inventoried roadless areas, which provide secure habitat, as well as well as forage and cover options for bears. Like the rest of the montane ecosystem, this area is under a special order for attractant storage.

The Pryor Mountains Geographic Area is within the distinct population segment for the Greater Yellowstone Ecosystem grizzly bear population, but is not identified as suitable habitat for grizzly bears, due to the isolated nature of the geographic area. The Custer Gallatin has no documented occurrences of grizzly bears in the Pryor Mountains. The Bighorn Mountains in Wyoming just south of the Pryor Mountains were considered by the U.S. Fish and Wildlife Service for habitat suitability. Since the range is separated from the current grizzly bear distribution by a distance greater than the average dispersal for both male and female grizzlies, immigration potential from occupied areas is limited. As such, isolated ranges like the Bighorns are likely not capable of supporting a self-sustaining grizzly bear population, and were therefore excluded from suitable habitat within the Greater Yellowstone Ecosystem distinct population segment for grizzly bears (USDI FWS 2017). While the Pryor Mountains were not specifically addressed by the U.S. Fish and Wildlife Service, the same logic applies; because the Pryor Mountains are separated by a greater distance, smaller, and have less total secure habitat than the Bridger Mountain Range, the Pryor Geographic Area does not provide good potential habitat connectivity for grizzly bear dispersal.

Key Stressors

Interactions with people are by far the leading factors affecting the Greater Yellowstone Ecosystem grizzly bear populations (USDI FWS 2016a, Schwartz et al. 2010), including those bears that inhabit, or pass through the Custer Gallatin National Forest. Motorized access routes (roads and trails) detract from secure habitat. Permitted livestock grazing allotments contain live animals, livestock feed and supplements, and occasionally livestock carcasses that may attract grizzly bears into potential conflict situations with people. Developed sites provide places for people to concentrate use, which can contribute disturbance factors that may displace wary bears, while at the same time often provide facilities for storing, preparing and eating food, or disposing of garbage, which may act as attractants for less wary bears. Availability of secure habitat, key natural food sources, and human-related attractants, can influence grizzly bear survival, reproductive success, and distribution.

Environmental Consequences

Management Direction under the Current Plans

Both of the existing plans contain goals to provide habitat that contributes to the recovery of threatened species.

The Gallatin forest plan, which dictates management for the majority of grizzly bear habitat on the Custer Gallatin National Forest, was amended in 2015 (Amendment 51) to update management direction for grizzly bear habitat, by formally adopting habitat management recommendations from the Greater Yellowstone Ecosystem Grizzly Bear Conservation Strategy, which are consistent with the habitat-based recovery criteria in the Grizzly Bear Recovery Plan (Servheen 2007, USFWS 2013). Accordingly, the existing Gallatin forest plan includes direction for retention of secure habitat over the long-term within the recovery zone or primary conservation area, including a measure that increased the baseline for secure habitat in three bear management subunits that were identified as needing improvement over the 1998 baseline. For these three subunits (Gallatin 3, Henrys Lake 2, and Madison 2), the new baseline for secure habitat became the level achieved with full implementation of the 2006 Gallatin Travel Management Plan. The new baseline produced increases of 15, 6, and 1 percent secure habitat for those subunits respectively (see table 59). Secure habitat is measured as a proportion of a bear management subunit (inside the recovery zone). Consistent with the Conservation Strategy, the existing Gallatin forest plan would allow for permanent changes in configuration of secure habitat inside the recovery zone, but losses of secure habitat due to new motorized routes must be replaced by restoring secure habitat (closing motorized routes) elsewhere in the same bear management subunit or in the nearest subunit possible. Temporary reductions in secure habitat below the appropriate baseline are allowed for administrative purposes, but are not to exceed 1 percent of the total acreage of the largest subunit within the affected bear management unit.

The Gallatin forest plan requires management of developed sites and permitted livestock grazing within the grizzly bear recovery zone or primary conservation area at or below numbers and capacity available in 1998. No vacant or closed sheep grazing allotments would be reactivated, nor would existing cattle or horse allotments be converted to allow sheep. In addition, the Gallatin Forest Plan (as amended 2015) adopted monitoring requirements from the Greater Yellowstone Ecosystem Grizzly Bear Conservation Strategy. There are currently no standards or guidelines that apply specifically to grizzly bear habitat management outside the recovery zone. However, the 2006 Gallatin Forest Travel Management Plan provides direction pertaining to access management, both within and outside the recovery zone, which affects secure habitat. In addition, the Travel Plan acknowledges the importance of travel corridors for wildlife by including forestwide and area-specific goals and objectives for managing access to provide habitat connectivity consistent with wildlife movement patterns.

The Custer forest plan contains broad direction to coordinate land management uses with grizzly bear habitat needs to avoid conflicts. Most of the standards for managing land uses consistent with grizzly bear habitat conservation specify that activities are to follow direction contained in the publication “Guidelines for Managing Grizzly Bears in the Greater Yellowstone Area” and cite to a 1979 Forest Service publication. This document delineated grizzly habitat by “management situation” areas. Custer Plan direction applies to grizzly bear management situation 1 and 2, which is the same geographic area as the recovery zone. The Custer forest plan was amended in 2006 (Amendment 42), to formally adopt the habitat standards from the Greater Yellowstone Ecosystem Grizzly Bear Conservation Strategy, anticipating delisting of the Greater Yellowstone Ecosystem grizzly bear population in 2007. However, the language in the amendment specified that the direction applied to a delisted population of grizzly bears. Amendment 42 remains in the Custer forest plan since it was never removed, but since the Greater Yellowstone Ecosystem grizzly population returned to threatened status after a 2018 court ruling, amendment 42 technically does not apply so long as the bear remains federally listed. Therefore, the Custer portion of the Custer Gallatin National Forest reverts back to plan direction in place prior to the amendment. The Custer forest plan does not contain direction specific to grizzly bear habitat management outside of the recovery zone, but like the Gallatin forest plan, the 2008 Beartooth Ranger District Travel Management Plan provides direction pertaining to motorized access management, which affects secure habitat both within and outside the recovery zone.

The Gallatin forest plan (as amended) emphasizes retention of mature and overmature (cone-producing) whitebark pine within the grizzly bear recovery zone, but the Custer forest plan contains no specific direction for whitebark pine. Both plans contain considerable direction for management of big game habitat, which is important for providing ungulate biomass for grizzly bears. Existing plan direction covers topics such as protection of big game winter ranges and calving areas, as well as providing hiding cover, security areas, and forage. Neither plan contains specific direction for management of bison, which are an important food source for grizzly bears in Yellowstone National Park, and may become more important on the Custer Gallatin as bison expand onto the national forest.

Effects of the Current Plans

Under the current plans, the Gallatin portion of the national forest would continue under plan direction implemented with amendment 51, which formally adopted habitat standards and monitoring items from the Greater Yellowstone Ecosystem Grizzly Bear Conservation Strategy regardless of the federal status of the bear, but the Custer portion of the national forest would revert to original plan language for grizzly bears. Under both the existing plans, grizzly bear numbers and distribution have increased since these plans were implemented in the mid-1980s (see figure 32 and figure 33).

Since the Gallatin portion of the national forest would operate under habitat standards adopted from the conservation strategy, effects from grizzly bear management direction on the Gallatin side would be the same as the revised plan alternatives, regardless of the legal status of the species. Under the existing Gallatin forest plan, secure habitat inside the recovery zone would be maintained at or above the proportions available in 1998 with increased baselines for the Gallatin 3, Madison 2 and Henrys Lake 2 bear management subunits. Aside from these three subunits, secure habitat has increased over 1998 baseline levels in nine additional subunits (refer to table 59), all of which would fall under Gallatin forest plan direction in alternative A. Under existing plan direction, management actions could be implemented that would reduce secure habitat back to 1998 levels in these subunits, and it is quite possible that large, localized reductions in secure habitat would have negative impacts on individual bears living in those areas. However, remaining secure habitat would continue to support grizzly bear recovery at the population level (Servheen 2007).

Under the existing Gallatin forest plan, the number and capacity of developed sites and livestock grazing allotments would remain at or below levels that occurred in 1998. Since there have been slight reductions in developed sites and grazing allotments, slight increases could occur under the existing plan and still be within the constraints of plan direction. While it is possible that grazing allotments could increase compared to existing levels, no new sheep allotments would be authorized, unless for the express purpose of administrative use for noxious weed control, which is not specifically prohibited in the conservation strategy, or the existing forest plan direction. The use of domestic livestock (sheep or goats) for weed treatment is typically much more focused in time and space than grazing for livestock production, and can therefore be tightly restricted to minimize potential risk of conflict with grizzlies. Increases in developed sites or grazing allotments could have negative impacts on individual bears, but impacts would be mitigated by proper food and attractant storage measures. While habitat conditions could revert to 1998 baseline conditions where some improvements have been made, the current best science indicates that conditions in 1998 provided adequate conditions inside the recovery zone to support and conserve a healthy grizzly bear population (Servheen 2007, USDI FWS 2017). Therefore, remaining habitat on the Custer Gallatin would still contribute to grizzly bear recovery.

The Custer Plan amendment incorporating habitat standards from the conservation strategy would not apply so long as the bear remains listed. However, nearly all (more than 96 percent) of the Custer portion of the grizzly bear recovery zone is within the Absaroka-Beartooth Wilderness Area, and is managed under the mandates of the Wilderness Act. Therefore, inside the recovery zone (or primary conservation area) where conservation strategy habitat standards should be applied, no motorized access would be allowed within the wilderness, and according to the Beartooth Ranger District Travel Management Plan, secure habitat would not be reduced below the 1998 baseline. There would be no increase in the number of developed sites or livestock grazing allotments inside the wilderness. Therefore, due to underlying wilderness area designation, the Custer portion of the area within the recovery zone and primary conservation area would be managed consistent with habitat standards in the conservation strategy.

Outside the recovery zone, neither the Custer nor the Gallatin existing plans contain specific direction for grizzly bear habitat. However, roughly 70 percent of the area outside the recovery zone but within the grizzly bear distribution area is within designated wilderness, the wilderness study area, or inventoried roadless areas, which come with land use restrictions that would maintain secure habitat to a large degree, and influence the potential for new developed sites and grazing allotments. Land managers across the Greater Yellowstone Ecosystem recognize that secure habitat is key to the long-term persistence of grizzly bears, and therefore the amount of secure habitat outside the recovery zone is monitored and reported biannually (Yellowstone Ecosystem Subcommittee 2016). Both the Custer and Gallatin portions of the grizzly bear distribution area (inside and outside the recovery zone) are under travel management plans that dictate how motorized routes (roads and trails) are managed, which influences secure habitat. Since these travel plans were completed, secure habitat outside the recovery zone has improved in 9 of the 11 bear analysis units monitored, and has stayed constant in the other two (table 60). Given the substantial amounts of designated wilderness, wilderness study area, and inventoried roadless areas outside the recovery zone, combined with motorized access restrictions contained in the travel management plans, secure habitat, developed sites and livestock allotments outside the recovery zone within the grizzly bear distribution area would stay relatively stable, but may see minor increases or decreases under the existing forest plans. Existing plan direction has facilitated expansion of grizzly bear distribution to cover the majority of suitable habitat outside the recovery zone within the Greater Yellowstone Ecosystem distinct population segment.

Big game populations have ebbed and flowed in numbers and distribution under existing plan direction. A more detailed analysis for elk, moose, and deer can be found in the Wildlife, Big Game section. Elk are the most abundant and widespread of the big game species on the Custer Gallatin, and as such provide the bulk of ungulate biomass for grizzly bears. In the Absaroka Beartooth and Madison, Henrys Lake, and Gallatin Geographic Areas where grizzly bears are known to occur, Montana Fish Wildlife and Parks reported that elk herds were above population objectives in most of the areas monitored (hunting districts) in 2018. Only one hunting district (310) in the Madison, Henrys Lake, and Gallatin Geographic Area just northwest of Yellowstone National Park, is currently below state population objectives for elk. Likewise, in the Bridger, Bangtail and Crazy Mountains Geographic Area, which provides potential habitat connectivity for grizzly bear dispersal between the Greater Yellowstone Ecosystem and other grizzly bear ecosystems, elk herds were primarily over State population objectives for elk (http://fwp.mt.gov/fishAndWildlife/management/elk). Therefore, under existing management direction, elk herds are currently largely within or over state population objectives, both in areas known to have grizzlies present as well as areas where grizzly bear dispersal is possible. Given this trend, it is expected that the Custer Gallatin would continue to provide abundant ungulate biomass for grizzly bears under the existing plans.

Whitebark pine distribution and seed production has declined markedly in recent years, largely due to mortality from mountain pine beetle infestations and to a lesser extent, damage from white pine blister rust (van Manen et al. 2013, Schwartz et al. 2014a, Gunther et al. 2014, Ebinger et al 2016, USDI FWS 2016a). A more detailed analysis of whitebark pine status, condition and trends can be found in the At-Risk Plant and Terrestrial Vegetation sections. When abundant, whitebark pine seeds are an important food source for grizzly bears in that they are easily digested, high in protein and fat content, and located in higher elevations that generally have greater proportions of secure habitat. Grizzly bears have a high degree of dietary plasticity and are very capable of shifting to alternate food sources when key food items are scarce or unavailable. Although whitebark pine remains an important and desirable food source for grizzly bears in the Greater Yellowstone Ecosystem, research has documented a substantial number of grizzly bear home ranges with little or no whitebark pine in them (Costello et al. 2014). Other bears that did show habitat selection for whitebark pine showed no notable changes in home range size, movement patterns or body condition as whitebark pine declined in the Greater Yellowstone Ecosystem (ibid., van Manen et al. 2013). However, Schwartz and others (Schwartz et al. 2010), reported an increase in grizzly bear-human conflicts in years of poor whitebark seed production.

Costello and associates (Costello et al. 2014) found that grizzly bears living outside of national parks were more likely to select for secure habitat than whitebark pine habitat. Based on multiple factors, the Interagency Grizzly Bear Study Team (van Manen et al. 2013) concluded that the recent decline in whitebark pine had no notable negative impact on grizzly bears in the Greater Yellowstone Ecosystem, either for individuals or at the population level. The Gallatin forest plan (as amended) includes a standard that vegetation management inside the recovery zone may not reduce the proportion of over-mature forest structure below 30 percent of the forested acres in a timber compartment. All tree species may contribute to meeting the standard, but whitebark pine is to be emphasized for retention. The Custer forest plan contains no specific direction for whitebark pine management; however, the vast majority of the Custer portion inside the recovery zone is in designated wilderness, where management actions would have little or no effect on whitebark pine. There is evidence to suggest that whitebark pine mortality may be declining in the Greater Yellowstone Ecosystem (Schwartz et al. 2014b). Natural waning of the mountain pine beetle epidemic, coupled with the existing standard for retaining mature whitebark pine and the underlying wilderness designations on the Custer Gallatin, would promote persistence of whitebark pine inside the recovery zone under the current plans. Therefore, whitebark pine would continue to provide a key food source for grizzly bears on the Custer Gallatin National Forest.

Existing plan direction has been effective at contributing to recovery of the Greater Yellowstone Ecosystem grizzly bear population. Management decisions focused on maintaining secure habitat and not increasing developed sites or livestock grazing allotments have worked collectively to allow for grizzly bear expansion into suitable habitats and reduced potential for human-caused grizzly bear mortality. Consistent with goals in both existing plans, food storage orders were established in grizzly bear distribution areas. Over time, the food storage orders have expanded geographically in pace with grizzly bear distribution expansion, and now cover all geographic areas in the montane ecosystem, which is substantially beyond current grizzly bear distribution. In the Montana portion of the Greater Yellowstone Ecosystem, which includes the Custer Gallatin, Frey and Smith (*in* vanManen et al. 2018) noted that sanitation efforts (food storage orders) combined with information and education have helped reduce incidents of bears obtaining human-related foods, thereby reducing the need for management actions that result in relocation or removal of grizzly bears. Even so, these authors reported a 30 percent increase in grizzly bear-human conflicts in the Montana portion of the Greater Yellowstone Ecosystem during the most recent decade (2008-2017) compared to the previous decade (1998-2007), but attributed this increase to the growing grizzly bear population and expanding distribution combined with a growing human population and associated increase in human activity in the grizzly bear distribution area. Human-caused grizzly bear mortalities have also shown a notable increase in the past decade relative to the previous decade, most likely due to these same factors.

Monitoring items were adopted from the conservation strategy into the Gallatin forest plan (as amended). Within the recovery zone, the amount of secure habitat, motorized access route densities, number and capacity of developed sites, and livestock grazing allotments would continue to be monitored and reported annually. Outside the recovery zone, changes in secure habitat would be monitored and reported bi-annually. In addition, the Custer Gallatin would continue to track all grizzly bear-human conflicts within and outside the recovery zone, and evaluate livestock allotments for recurring conflicts with grizzly bears. Finally, the Custer Gallatin would assist with Greater Yellowstone

Ecosystem monitoring of key grizzly bear food items as needed. Continuing these monitoring items would allow the Custer Gallatin to evaluate effectiveness of plan direction, and if need be, respond to demonstrated issues in grizzly bear habitat in cooperation with other agencies. No specific grizzly bear monitoring items are included in the existing Custer forest plan. However, management-related issues are not expected to occur inside the recovery zone, which is nearly all wilderness. Further, the Custer National Forest has, and would continue to participate in the above-mentioned monitoring items outside of the recovery zone, in accordance with the conservation strategy.

The distinct population segment for the Greater Yellowstone Ecosystem grizzly population is all south of Interstate 90, and no grizzly bears from the Greater Yellowstone Ecosystem have been documented north of Interstate 90 in many years. DNA analyses have concluded that the Greater Yellowstone Ecosystem grizzly bear population is genetically isolated from other grizzly bears (USDI FWS 2017). However, the Greater Yellowstone Ecosystem population has been increasing, and has surpassed the estimated effective population size (500 animals) to avoid inbreeding depression, greatly reducing the concern for genetic health of the population (Kamath et al. 2015). Genetic interchange between the Greater Yellowstone Ecosystem and other grizzly populations is desirable as it would increase genetic diversity and be beneficial to long-term persistence of affected populations (USDI FWS 2017). The Greater Yellowstone Ecosystem is the southernmost, and one of the largest grizzly bear populations remaining in the continental United States. The other large grizzly bear population in the lower 48, and also the closest to the Greater Yellowstone Ecosystem, is the Northern Continental Divide Ecosystem, the core of which is located in northwestern Montana. The Northern Continental Divide Ecosystem population is not only important because of its size and proximity to the Greater Yellowstone Ecosystem, but also because it is contiguous with grizzly bear populations in Canada, which enhances the genetic diversity of the population.

Isolated mountain ranges in the Bridger, Bangtail and Crazy Mountains Geographic Area have been identified as potential travel corridors between the Northern Continental Divide Ecosystem and the Greater Yellowstone Ecosystem (Walker and Craighead 1997, Cushman et al. 2009, Peck et al. 2017), and the Bridger/Bangtail Ranges are included in the Northern Continental Divide Ecosystem Grizzly Bear Conservation Strategy as “Management Zone 2,” which denotes areas to be managed for opportunistic movement of grizzly bears between ecosystems. Management emphasis for Zone 2 is conflict prevention through appropriate storage of potential bear attractants (NCDE Subcommittee 2018). Although the existing Gallatin forest plan does not include specific direction for attractant storage, all Custer Gallatin lands within Northern Continental Divide Ecosystem Zone 2 are currently under a special order that mandates appropriate storage of food and other attractants. This order would remain in place under the current plans, effectively minimizing potential for dispersing grizzly bears to get into food-related conflicts with humans.

In summary, direction for managing grizzly bear habitat in existing plans has facilitated growth in both numbers and distribution of bears within and outside of the recovery zone since the original plans were established. Secure habitat has increased considerably, while the number of developed sites and livestock allotments have declined slightly inside the recovery zone. Sheep grazing allotments were completely eliminated from the recovery zone, and a special order for proper storage of food and attractants has been in place within the grizzly bear distribution area and beyond. All of these factors have improved conditions for grizzly bears compared to the 1980s when these plans were established.

Accordingly, while there could be negative effects to individual bears, the Custer Gallatin would continue to contribute to grizzly bear recovery under the existing plan direction.

Management Direction under the Revised Plan Alternatives

All revised plan alternatives include desired conditions for habitat that contributes to species recovery, and for stable or increasing population trends for listed species. Under all alternatives, desired conditions state that grizzly bears, including reproductive females, are present and well distributed within the recovery zone, and that grizzly bears occur where habitat is biologically suitable and their presence is socially acceptable outside the recovery zone. Desired conditions also reflect that secure habitat outside the recovery zone contributes to habitat connectivity and facilitates grizzly bear movement between grizzly bear ecosystems, with a goal to ultimately achieve successful dispersal of grizzlies between ecosystems. General desired conditions for wildlife include vegetation conditions that are generally within the natural range of variation to provide habitat diversity for assorted life cycle needs of a broad suite of wildlife species, as well as conditions that provide security and refuge for wildlife to escape from stresses and threats. All revised plan alternatives contain a desired condition that human-related foods and attractants are unavailable to wildlife, with an associated standard that a food and attractant storage special order shall apply to the Absaroka Beartooth, Bridger, Bangtail and Crazy Mountains; Madison, Henrys Lake, and Gallatin; and Pryor Mountains Geographic Areas.

Similar to the current plans, all revised plan alternatives require secure habitat inside the recovery zone to be maintained over the long term in all bear management subunits at or above appropriate baseline levels. Permanent changes in secure habitat could affect configuration across the landscape, but would require compensation within the same bear management subunit, or the nearest subunit possible, to maintain secure habitat levels at or above appropriate baseline levels. Temporary decreases in secure habitat would be allowed below baseline levels for management purposes, but would not be allowed to exceed 1 percent of the acreage in the largest subunit within the bear management unit affected. Likewise, the number and capacity of developed sites, as well as the number and acreage of permitted livestock grazing allotments inside the recovery zone would be maintained at or below 1998 baseline levels. Under all revised plan alternatives, grazing of domestic sheep would not be permitted within the recovery zone for purposes of livestock production. Under alternatives B, C and E, targeted grazing of domestic sheep or goats could be used administratively for the express purpose of noxious weed treatment, with appropriate mitigation measures to minimize risk of potential conflict with grizzly bears. Alternative D would not allow administrative use of domestic sheep or goats for weed control.

In addition to grizzly bear-specific direction, all revised plan alternatives include other wildlife plan components that may affect grizzly bears. All revised plan alternatives contain plan components for management of big game habitat, including guidelines to protect winter range, reproductive areas, and secure habitat, plus specific direction for bison and bighorn sheep (*Ovis canadensis*), which could influence grizzly bear habitat conditions. Alternatives B, C and D include proactive plan components to facilitate bison expansion on the Custer Gallatin National Forest. Further, alternatives B, C and D adopt specific plan components for wildlife habitat connectivity, which would impose additional protection for secure habitat as well as restrictions on new developed sites in locations identified as key linkage areas outside the recovery zone.

All revised plan alternatives include desired conditions, standards and guidelines pertaining to composition, structure and landscape pattern of vegetation, with the intent to achieve conditions that are within the natural range of variation, thereby providing for ecological integrity, diversity, function and resiliency of wildlife habitat. The Terrestrial Vegetation section of the plan includes quantitative and qualitative estimates of the natural range of variation for key ecological characteristics of forested and non-forested habitats (see tables in the Terrestrial Vegetation section). Specific plan components for terrestrial vegetation, at risk plants, water, and riparian areas all influence grizzly bear habitat, as well as habitat for grizzly bear prey species. The revised plan alternatives include specific guidelines for management of whitebark pine, old growth, forest cover, and riparian areas, all of which are important habitat elements for grizzly bears.

Finally, all revised plan alternatives include objectives to annually implement projects specifically designed to restore habitat or populations of at-risk species, as well as annual projects to maintain or improve habitat for one or more terrestrial wildlife species.

Effects of the Revised Plan Alternatives

Under all revised plan alternatives, the area within the grizzly bear recovery zone would be managed under concepts outlined in the Greater Yellowstone Ecosystem Grizzly Bear Conservation Strategy (Yellowstone Ecosystem Subcommittee 2016), on both the Custer and Gallatin portions of the national forest, regardless of the federal status of the grizzly bear. Habitat recommendations in the conservation strategy are based upon the best available scientific information specific to grizzly bear habitat management in the Greater Yellowstone Ecosystem. The habitat management recommendations in the conservation strategy are consistent with the grizzly bear recovery plan as amended (Servheen 2007), and have demonstrated effectiveness in reducing bear-human conflicts and allowing for expansion of grizzly bear distribution across the national forest. Effects from the grizzly bear specific plan direction would be the same under all revised plan alternatives, and would be similar to the current plans.

The primary change from the current plans is that the Custer portion of the plan would be under conservation strategy recommendations regardless of whether the grizzly bear is listed or delisted, which has been a moving target in recent years. This change would provide a permanent update for the Custer portion of the national forest, resulting in more consistent management direction for the consolidated Custer Gallatin National Forest. Under all revised plan alternatives, the basis for grizzly bear habitat management across the Custer Gallatin would be the same as for the Gallatin portion of the national forest in the current Gallatin forest plan (adoption of Greater Yellowstone Ecosystem Grizzly Bear Conservation Strategy habitat management recommendations). However, specific plan components were reworded to be consistent with the 2012 Planning Rule definitions, and attempts were made to clarify language for more consistent application through implementation. Finally, the existing Gallatin forest plan (as amended) adopted language from the 2007 version of the conservation strategy, which was updated in 2016. There were no substantive changes in habitat management criteria or monitoring items between the 2007 and 2016 versions of the conservation strategy, so the conservation strategy update had little effect on plan components adopted under all revised plan alternatives.

Another difference between the revised plan alternatives and the current plans is the inclusion of specific desired conditions for grizzly bears, which speak to presence and distribution of grizzly bears, including reproductive females, inside and outside of the recovery zone, as well as the desire to provide habitat connectivity to facilitate grizzly bear movement and promote genetic interchange between grizzly bear ecosystems. These desired conditions would ensure consideration of potential impacts to grizzly bears from management proposals both within and outside the recovery zone, and create a more cohesive vision of grizzly bear habitat needs across the entire national forest by formally incorporating concepts previously practiced under interagency agreements to meet the intent of the conservation strategy. The desired condition to provide habitat connectivity for grizzly bear movement between ecosystems is not a new concept in science, but fills a void where existing plans lacked specific direction.

Grizzly bear habitat standards would maintain proportions of secure habitat inside the recovery zone at or above levels present in 1998, including higher baseline levels for three subunits as described previously for the current plans. Permanent and temporary changes to secure habitat inside the recovery zone could occur, and would be the same as described for the current plans. Like the current plans, the revised plan alternatives contain no plan components specific to grizzly bears that would restrict land management actions outside the recovery zone. However, in areas where secure habitat is limited, all revised plan alternatives include a guideline that secure habitat should not be reduced during big game hunting seasons. In key linkage areas (alternatives B, C and D), new permanent facilities and structures are limited and years of management activity must be followed by “rest” years with limited management activity. Furthermore, all revised plan alternatives incorporate forestwide plan components specifically designed to protect riparian areas, including restrictions on road construction within riparian habitats (see the Watershed, Aquatic Species and Riparian Ecosystems sections for more details). Collectively, these components would protect more secure habitat outside the recovery zone than would occur under the current plans.

Grizzly bear-related management of developed sites would be the same as described for the current plans, except that the revised plan alternatives add a desired condition and a standard for proper management of food and other attractants in areas where grizzly bears are now, or may be expected to occur in the future. A food storage special order is currently in place and has been for some time, but is not mandated under the existing plans. Incorporating plan components would ensure that emphasis on proper storage of food and attractants continues into the foreseeable future. As noted previously, the conservation strategy proposed a review of the developed site standards relative to the baseline. Results of this review were not available at the time this analysis was written. However, if this review results in timely recommendations for changes to the developed site standards or baseline, the effects of such changes may be disclosed in the final environmental impacts statement for forest plan revision. Grizzly bear-specific plan components do not restrict construction of new developed sites outside the recovery zone. However, plan components for riparian management zones (all revised plan alternatives) and key linkage areas (alternatives B, C and D) would limit new developed sites in these areas, allowing fewer new developed sites outside the recovery zone than could potentially occur under the current plans.

Management of livestock allotments inside the recovery zone would be similar to the current plans, except that use of livestock (domestic sheep or goats) for weed treatment is specifically addressed in the revised plan alternatives for grizzly bears, whereas the existing plans and the Greater Yellowstone Ecosystem conservation strategy are silent, and thus permissive on this issue. Alternatives B, C and E contain direction that would require written instructions for authorizing use of livestock for weed treatment inside the recovery zone. Instructions would address pertinent factors needed to minimize risk of conflicts with grizzly bears. Grizzly bear-livestock conflicts that do arise would generally be managed in favor of the bears. Outside the recovery zone, domestic sheep and goats may be used for weed treatment, but grizzly bears are still given favorable consideration in the event of livestock depredations. Alternative D would not allow administrative use of domestic sheep or goats for weed control inside or outside of the recovery zone.

Grizzly bears occasionally kill cattle, but they often coexist with cattle without depredation, whereas domestic sheep are a known grizzly bear attractant, and bears that encounter domestic sheep are more likely to respond with depredation (USDI FWS 2017). Grizzly bear depredations on livestock can result in injury or removal of bears. On the other hand, noxious weeds are also a threat to the environment, and can affect availability of plant foods for grizzly bears, as well as reduce forage available to grizzly bear prey species such as wild ungulates. Under alternatives B, C and E, use of domestic sheep or goats for targeted weed treatment would allow for strategic management to reduce environmental impacts from noxious weeds, while imposing tight restrictions to manage potential risk of conflict with grizzly bears. Alternative D would more effectively minimize risk of conflict between grizzly bears and domestic sheep by precluding the presence of sheep for all purposes. However, since administrative use of domestic sheep for weed control would be tightly managed under alternatives B, C and E, with potential conflicts generally resolved in favor of bears, the benefits to be gained through weed management would outweigh the potential risk to grizzly bears.

In addition to direction for grizzly bears, the revised plan alternatives include considerations for bison that could affect grizzly bears. All revised plan alternatives include desired conditions that allow for natural expansion of bison into suitable habitats on the Custer Gallatin National Forest, which could result in increased ungulate biomass for grizzly bears. Further, alternatives B, C and D include objectives to implement bison habitat improvement projects, which again, could eventually result in more bison on the Custer Gallatin, and thus, more ungulate biomass available to grizzly bears. Alternatives B, C and D also include guidelines to manage potential conflicts between bison and cattle in favor of bison, which would benefit grizzlies both from the standpoint of providing added ungulate biomass from bison, but also possibly reducing the potential for grizzly bear conflicts with domestic livestock if livestock numbers or seasons of use are reduced. Although alternative E would have desired conditions for continued natural bison expansion onto the Custer Gallatin National Forest, there would be no objectives for bison habitat improvement, and conflicts between bison and livestock would be resolved in favor of livestock. Existing plans have no language pertaining to management of bison habitat, whereas all revised plan alternatives contain affirmative desired conditions for bison expansion onto the national forest. Therefore, all revised plan alternatives would benefit grizzly bears more than the current plans, although alternative E would have fewer positive management strategies for bison than the other revised plan alternatives.

Plan components for bighorn sheep that would influence how domestic sheep grazing allotments may be authorized, could also influence grizzly bear habitat conditions, within and outside of the recovery zone. Under alternatives B and C, stocking of permitted grazing allotments with domestic sheep or goats for livestock production or recreational packing would not be permitted in the Absaroka Beartooth and Madison, Henrys Lake, and Gallatin; and Pryor Mountains Geographic Areas. There are currently no sheep or goat-grazing allotments on the national forest, and alternatives B, C and D would ensure that no future sheep allotments are established on the Custer Gallatin National Forest portion of the Greater Yellowstone Ecosystem grizzly bear distinct population segment area.

Alternative D would further prohibit stocking of permitted grazing allotments with domestic sheep or goats for livestock production or recreational packing across the entire Custer Gallatin, which would ensure that presence of domestic sheep is minimized not only within the current grizzly bear distribution area, but also in areas where grizzly bears may expand or disperse through in the future.

Alternative E would allow stocking of permitted grazing allotments with domestic sheep or goats for livestock production or recreational packing outside the recovery zone similar to the current plans. However, alternative E includes requirements to minimize risk of bighorn sheep exposure to domestics, which are not present in the current plans.

Under alternatives B, C and E, sheep and goats could be used for targeted weed treatment, both inside and outside the recovery zone, but such use would be mitigated for potential effects to both grizzly bears and bighorn sheep. This use would not be allowed in alternative D, potentially leading to greater weed distribution and concentration, although lower risks for grizzly bear conflicts with domestic sheep and goats.

Finally, all revised plan alternatives formally incorporate through desired condition and a standard, application of a special order to regulate the proper storage of attractants in grizzly bear habitat. A special order for proper storage of food and attractants is currently in place, which requires proper management of animal carcasses when livestock die on National Forest System lands. Revised plan components would ensure that proper management of attractants continues into the foreseeable future. With added restrictions on presence of domestic sheep across the Custer Gallatin and added emphasis on proper management of attractants, all revised plan alternatives would reduce mortality risk to grizzly bears compared to the current plans.

All revised plan alternatives include desired conditions, standards, guidelines and objectives for management of big game species that would affect the availability of ungulate biomass available for grizzly bears. Specifically, all revised plan alternatives would recognize the distinctive roles and contributions of bison on the Custer Gallatin National Forest. All revised plan alternatives include desired conditions for expansion of bison distribution on the Custer Gallatin, including a desire for year-round bison presence under alternative D. To this end, all alternatives contain guidelines to limit management-related impediments to bison movement, and to encourage strategic management of habitat, including timing and location of bison habitat improvement projects. Alternatives B, C and D contain objectives for proactive habitat management for bison, and guidelines for management actions that favor bison over livestock where conflicts occur. Bison are a major food source for grizzly bears in some areas of the Greater Yellowstone Ecosystem, most notably in Yellowstone Park (USDI FWS 2017). However bison have been moving onto the Custer Gallatin National Forest in recent years, and bears have been observed feeding on bison carcasses there, but to date, such occurrences are spatially limited. Expansion of bison distribution, plus increased bison numbers and time spent on the Custer Gallatin would benefit grizzly bears through increased opportunities for scavenging carcasses and to a lesser extent, increased prey availability.

All revised plan alternatives include plan components limiting disruptions of big game species on winter ranges and reproductive areas. General plan components for big game species are expected to contribute to long-term persistence of species such as elk, moose and deer, similar to conditions under the current plans. However, existing plans have no direction specific to bison, whereas all revised plan alternatives contain affirmative plan components for bison, which would benefit grizzly bears to varying degrees. Refer to the Wildlife, Bison, and Big Game sections for more details concerning effects to big game populations.

All revised plan alternatives contain plan components specifically designed to protect, restore, and ultimately increase the presence of whitebark pine, which is a key food source for grizzly bears. Plan components in the revised plan alternatives include goals to coordinate management, and assimilate whitebark pine conservation strategies developed by an interagency whitebark pine subcommittee. All revised plan alternatives include desired conditions for whitebark pine relative to tree species dominance, tree species presence, large tree size class, and patch size of larger trees. The alternatives include a standard to avoid or mitigate for potential adverse effects of management activities on whitebark pine, and guidelines to protect whitebark pine "plus trees" (genetically resistant to blister rust) as well as whitebark pine seed orchards. Finally, all revised plan alternatives contain objectives for restoration of at-risk species populations or habitats, which could include whitebark pine. These components provide detailed, clear and specific management direction aimed at maintaining or increasing whitebark pine across the landscape, rather than just inside the recovery zone.

Collectively, the plan components for whitebark pine would promote restoration of whitebark pine in areas hard hit by recent insect and disease outbreaks, increase presence and dominance of the species, and increase trees size class and patch size of larger trees, which would result in greater seed production. Therefore, proposed direction under the revised plan alternatives is more proactive and affirmative than language in existing plans, and resulting management would contribute more toward long-term persistence of this key food source for grizzly bears, both within and outside the recovery zone. Thus, the revised plan alternatives would provide greater benefit for grizzly bears than existing plans relative to this key food source. Refer to the At-Risk Plant and Terrestrial Vegetation sections for more detailed analyses of whitebark pine.

Under all revised plan alternatives, the vegetation plan components address the ecological structure, composition and function of vegetation conditions, ultimately striving for habitat conditions that are within the natural range of variation; such conditions would emulate the habitat conditions in which grizzly bears have evolved on the Custer Gallatin National Forest. Managing within the natural range of variation would help provide a level of habitat diversity that presents a wide variety of foraging opportunities for grizzly bears, including a range of alternate food sources for bears to supplement their diet when key foods are less available. Notably, all revised plan alternatives include desired conditions and related guidelines for maintaining or increasing the proportion of old growth forest, and a myriad of components aimed at protecting or restoring riparian management areas (see Terrestrial Vegetation; Water, Aquatics and Riparian Ecosystem sections for more detailed analysis. Old growth forest and riparian habitats are noted for high levels of plant and animal diversity, (Ward Thomas et al. 1988, Naiman et al. 1993), providing potential foraging areas and travel corridors for grizzly bears (USDI FWS 2017, Peck et al. 2017). The revised plan alternatives provide more specific guidance for vegetation management in terms of species composition, size and age class, structure, and patch size than currently contained in existing plans. All revised plan alternative desired conditions for terrestrial vegetation reflect a mosaic of forest and non-forest habitats that would provide both foraging opportunities and hiding cover for grizzly bears as well as for their prey species. Under all revised plan alternatives, the greater emphasis on restoration and maintenance of biodiversity and ecological integrity would benefit grizzly bears more than the existing plans.

Finally, the revised plan alternatives contain a suite of plan components to provide habitat connectivity specifically for grizzly bears, but also for wildlife in general with an emphasis on wide-ranging species such as large carnivores and wild ungulates. The Greater Yellowstone Ecosystem grizzly bear population has likely been geographically and genetically isolated from other grizzly bear populations for 100 years or more (USDI FWS 2017). Maintaining or restoring habitat connectivity would facilitate grizzly bear movement between the Greater Yellowstone Ecosystem and the Northern Continental Divide Ecosystem, which are the two largest grizzly populations in the continental United States. Grizzly bear movement between these ecosystems would enhance the genetic diversity and related long-term persistence of one or both populations, which is a long-term management goal under the revised plan alternatives. In addition to desired conditions, goals, and guidelines for habitat connectivity, alternatives B, C and D include forest plan allocations for key linkage areas, which are specific areas most likely to provide habitat connectivity between large blocks of contiguous wildlife habitat, due to their geographic proximity to other blocks of public land, presence of secure habitat, and orientation on the landscape.

Alternatives B, C and D allocate portions of the Gallatin and Bridger Mountain Ranges as key linkage areas. Since there has been no evidence of recent genetic exchange between Greater Yellowstone Ecosystem and Northern Continental Divide Ecosystem grizzly bears, (Haroldson et al. 2010), there is limited empirical data upon which to identify potential movement corridors for grizzly bears. However, current best available scientific information supports the key linkage areas identified in alternatives B, C and D as likely travel routes for grizzly bears (Walker and Craighead 1997, Cushman, McKelvey and Schwartz 2009, Peck et al. 2017). Most recently, Peck and associates (2017) noted that grizzly bears from both the Greater Yellowstone and Northern Continental Divide Ecosystems are expanding in distribution, such that the current closest proximity between the two ecosystems has recently come within the maximum dispersal range for male grizzly bears in the continental United States, making it more likely that successful grizzly bear dispersal between the two ecosystems could occur in the future. Based on grizzly bear location data and known grizzly bear use patterns for the two ecosystems, Peck and others (ibid.) identified potential corridors linking the two ecosystems for grizzly bears, in which, the key linkage areas identified in alternatives B, C and D are shown to be of high importance. Plan components that limit new developments and impose timing restrictions on major disturbance factors within key linkage areas would serve to maintain the ecological integrity of potential movement corridors for grizzly bears.

Alternatives A and E would not have key linkage areas, nor plan components specific to key linkage areas, although alternative E would still have general desired conditions and goals for habitat connectivity that are not included in existing plans. Under alternatives A and E, both the north end of the Gallatin Range and the Bridger Range would have some land use restrictions associated with inventoried roadless areas, but they would apply to smaller areas, and would have no additional plan components associated with key linkage areas common to alternatives B, C and D. Due to existing habitat quality and limitations imposed in inventoried roadless areas, alternatives A and E would maintain habitat connectivity to a certain degree, but would not would not specifically protect areas in closest proximity for wildlife movement between the Gallatin and Bridger Ranges as is the case in the other revised plan alternatives. Alternatives B, C, and D would facilitate grizzly bear movement between populations to a greater extent than alternatives A and E.

In addition to the Gallatin/Bridger mountain connection, research has shown a potential movement corridor between the Madison Range on the Custer Gallatin and the Tobacco Root/Gravelly mountains to the west and northwest, although this route was rated as secondary, or even inferior, to the Gallatin/Bridger connection (Walker and Craighead 1997, Cushman et al. 2009, Peck et al. 2017). While this route was also shown to be of some importance in general wildlife habitat connectivity modeling specific to Custer Gallatin Forest plan revision, it was not identified as a key linkage area, due to less predicted use by wildlife, which is consistent with literature for bears (ibid.). However, a considerable amount of National Forest System lands along this corridor are already within designated wilderness

(Lee Metcalf) so it would not be subject to the same potential management pressures facing the Gallatin/Bridger Mountain connection. Regardless of forest plan direction, there are still potential barriers to grizzly bear dispersal between the two ecosystems, including interstate and local highways, railways, and major human developments to name a few. These features are almost always located outside the national forest boundary, and beyond the authority of the Custer Gallatin forest plan. All revised plan alternatives include a goal to work with State, Federal, Tribal and other willing partners to continue to address the issue of linkage between grizzly bear ecosystems, which would include consideration of habitat connectivity outside the national forest boundary.

Consequences to Grizzly Bears from Forest Plan Components Associated with Other Resource Programs or Management Activities

Effects from Fire and Fuels Management

All revised plan alternatives contain desired conditions for wildland fires that burn with a range of intensity, severity, and frequency that allows ecosystems to function in a resilient and sustainable manner, and vegetation conditions that support natural fire regimes. Objectives are included in all revised plan alternatives to reduce hazardous fuels and allow a certain level of natural wildfires to burn. Minimum impact suppression tactics are recommended to minimize natural resource damage. Grizzly bears evolved with and adapted to natural fire regimes in the Greater Yellowstone Ecosystem, and benefit from the habitat diversity created by fires burning within natural regimes. Hazardous fuel reduction projects may be designed to change the natural structure and function of vegetation over time, which could impact grizzly bears by reducing certain plant foods (such as berry-producing shrubs), and by reducing hiding cover used by grizzly bears and their prey species.

Generally, fuel reduction projects are concentrated within or near areas that contain “values at risk”, which frequently include areas of high population densities such as residential areas and developed recreation sites. To minimize risk of grizzly bear-human conflicts, it is not desirable to manage habitat near areas of high human use to attract grizzly bears. Fuels reduction projects may occur in other areas as well, but would generally be designed to promote more natural fire behavior patterns in the long run. Minimum impact suppression tactics could be used to protect important grizzly bear habitat elements such as whitebark pine and riparian areas. As with vegetation management, fire and fuels management under the revised plan alternatives would have a greater emphasis on fire as a natural ecological process than under the current plans. Fire and fuels management direction under all alternatives would be consistent with grizzly bear conservation goals.

Effects from Timber Management

Timber management can affect grizzly bears by altering habitat as well as through disturbance effects that can cause displacement of bears from suitable habitat, or modify grizzly bear behavior patterns in ways that could affect foraging effectiveness, energy reserves, and risk of being killed. The primary factor related to timber harvest that would affect grizzly bears is the need for new road access. Inside the recovery zone, the secure habitat standard for grizzly bears would allow timber harvest under all alternatives, but would limit the amount of new roads that could be built. Under existing plans (alternative A), timber harvest for the purpose of timber production could occur only on about 14 percent of the combined Absaroka Beartooth and Madison, Henrys Lake, and Gallatin Geographic Areas, which coincides with the current grizzly bear distribution area. The proportion of these geographic areas that are suitable for timber production declines slightly under all revised plan alternatives, to 12 percent in alternatives B, C and E, and 11 percent in alternative D, leaving the vast majority of the landscape in areas not suitable for timber production under all alternatives. Timber harvest for the purpose of timber production may use even-aged regeneration harvest in which all or nearly all of the trees are removed, or uneven aged regeneration harvest, which typically removes the majority of trees, but leaves groups or individual trees behind for seed source or other purposes. Timber harvest reduces forest cover for bears and prey species, but often results in increased forage for bears and prey species, because removal of forest canopy allows more sunlight to reach the ground, stimulating growth of grasses, forbs and shrubs.

Timber harvest may occur in other areas where it is suitable, but only for resource management needs other than timber production, such as vegetation restoration, fuel reduction, wildlife habitat improvement, or other purposes. These types of projects often use prescriptions that generally remove smaller trees for purposes such as promoting individual tree growth, removing ladder fuels, or targeting improvement of particular tree species (such as aspen and whitebark pine). Some areas such as designated wilderness are not suitable for timber harvest for any purpose, while other areas such as the wilderness study area or inventoried roadless areas, limit the amount of road building and average size of trees that can be removed. Under all revised plan alternatives, timber harvest on lands not suitable for timber production (but where harvest is allowed for other purposes), would be used primarily for restoration purposes, with the intent of moving vegetation conditions toward desired conditions, with more of a focus on maintaining or restoring ecological integrity than is explicit under direction contained in existing plans. The exception would be for fuel reduction or hazard tree removal, which would typically occur within or near developed sites or other areas of concentrated human use, where it is not desirable to encourage grizzly bear use.

Acreage of predicted timber harvest including both the areas suitable for timber production and areas available for timber harvest for other resource reasons, varies between alternatives, with a high of about 41,500 acres per decade affected under alternative D, and a low of roughly 18,000 acres per decade affected under alternative E. Alternatives A, B and C are all similar at roughly 30,000 acres treated with timber harvest per decade. While alternative D has the least amount of area suitable for timber production, it has the highest predicted acres of timber harvest per decade due to a greater emphasis on restoring vegetation conditions within the natural range of variation. Consequently, alternative D would rely more heavily on harvest prescriptions that typically remove smaller diameter trees, with less emphasis on timber production, and therefore far fewer acres of regeneration harvest that not only removes the larger trees, but typically removes all or most of the trees. In contrast, alternative E has the largest area suitable for timber production, but the least acres predicted to be treated with timber harvest per decade. In alternative E, the emphasis would be on timber production, resulting in more acres treated with regeneration harvest to produce the greatest volume of lumber, and far fewer acres treated with prescriptions for ecological restoration purposes. Alternatives A, B and C would all fall in the mid-range of these alternatives, but generally emphasizing restoration over timber production. More acreage of timber harvest is expected to require more additional road access, which would most likely reduce secure habitat for grizzly bears. However, within the grizzly bear distribution area, all new roads required for timber harvest would be temporary roads used for administrative purposes (not open to public access). Therefore, effects to secure habitat would be temporary, and activities allowed would be more tightly controlled than on National Forest System roads open to public use.

Timber harvest, whether for timber production or for other resource management purposes, would have short-term disturbance impacts to grizzly bears, due to added noise and disturbance from road construction and use, as well as timber felling, collecting and transport. However, timber harvest can also result in short- and long-term benefits to bears, particularly when used for ecological restoration purposes. For example, timber harvest can result in short-term increases in forage for grizzly bears and their prey species. Timber harvest could also be used to move vegetation structure and pattern toward desired conditions, which may benefit bears by providing conditions closer to those that bears have evolved with and adapted to over time. Given these factors, alternative D would likely have the greatest short-term disturbance effects to bears associated with more acreage of treatment, but potentially the greatest long-term benefit due to greater emphasis on restoration. On the other end of the spectrum, alternative E would actually have the least amount of short-term disturbance impacts due to fewer overall acres treated, but would have more emphasis on timber production, reducing resources available for restoration purposes. Finally, timber harvest could be used to maintain or restore whitebark pine, which is a key food source for grizzly bears. Whitebark pine is not a commercial tree species, so under all alternatives, the only anticipated timber harvest that could affect whitebark pine would be for restoration purposes. Alternative D has the greatest potential for timber harvest to be used for whitebark pine restoration, alternatives A, B and C have intermediate potential, and alternative E has the least potential for timber harvest to be used for whitebark pine restoration.

Effects from Land Allocations

Designated areas such as wilderness, wilderness study areas, and inventoried roadless areas are created by authorities outside of the Forest Service and do not change between alternatives. The proportion of the grizzly bear distribution area (Absaroka Beartooth and Madison, Henrys Lake, and Gallatin Geographic Areas) within designated wilderness, the wilderness study area, or inventoried roadless areas, both within and outside the recovery zone, remain the same as indicated in the Affected Environment section. Forest plan allocations identify areas for specific types of management emphases, and do vary by alternative. Forest plan allocations may overlap existing designations of wilderness study area or inventoried roadless areas. The three types of forest plan allocations most pertinent to grizzly bear habitat management include recommended wilderness, backcountry areas, and recreation emphasis areas, which are listed here in the order of most management restrictions to least.

Recommended wilderness areas are lands that contain wilderness characteristics and have potential for inclusion in future wilderness designations. These lands are generally free from roads and other constructed features. Under all alternatives, recommended wilderness areas would be managed to maintain their wilderness character, including a natural environment where ecological processes function as the primary forces affecting the environment. No new roads could be constructed in recommended wilderness areas. New recreational motorized and mechanized means of transport in alternative B and all recreational motorized and mechanized means of transport in alternatives C and D would no longer be suitable uses. Some motorized or mechanized use for administrative purposes could occur in all alternatives. Inside the recovery zone, grizzly bear plan components for secure habitat already limit such uses, but recommended wilderness area allocation would maintain secure habitat outside the recovery zone. New developed recreation sites would not be allowed in recommended wilderness areas, which would benefit grizzly bears in areas outside the recovery zone, where grizzly bear plan components limiting developed sites do not apply. No new livestock allotments would be allowed in recommended wilderness areas, which again, would benefit grizzly bears outside the recovery zone. In summary, recommended wilderness areas outside of the recovery zone would provide similar conditions that benefit grizzly bears inside the recovery zone. Alternative D has the largest amount of recommended wilderness area proposed outside the recovery zone, followed by alternatives C, B and A. Alternative E has no recommended wilderness area identified outside the recovery zone.

Backcountry areas are generally undeveloped or lightly developed. Some either have a few primitive roads and motorized trails, while others have neither roads nor motorized trails. Under all revised plan alternatives, plan components would keep backcountry areas in a largely undeveloped condition where natural processes play their role and human use leaves little permanent or long lasting evidence. New roads and developed sites generally would not be allowed in backcountry areas, but existing roads, trails and developed sites would remain, and there would be more management flexibility for additional development in backcountry areas compared to recommended wilderness areas. Since grizzly bear direction already limits development inside the recovery zone, forest plan allocations for backcountry areas would primarily affect grizzly bears outside the recovery zone, similar to effects described for recommended wilderness areas, but with slightly more options for development. Alternative A (the current plans) has no forest plan allocation similar to backcountry areas in the grizzly bear distribution area. Alternative D also has no backcountry areas, but has recommended wilderness areas in most areas where backcountry areas are proposed in other alternatives; so it would provide the greatest level of restrictions that would benefit bears outside the recovery zone. Alternative C has a larger combination of recommended wilderness areas and backcountry areas outside the recovery zone than alternative B. Alternative E has backcountry areas identified outside the recovery zone in areas that are either mostly or entirely identified as recommended wilderness areas in alternatives B, C and D.

Recreation emphasis areas typically offer a variety of recreation opportunities, including motorized and nonmotorized uses. These areas may be regional, national, or international destinations, or may be close to human population centers. As such, recreation emphasis areas may have relatively high densities of roads, utilities, and trails, with associated high levels of human use. While recreation is the management emphasis for recreation emphasis areas, vegetation management would not be precluded. Inside the recovery zone, grizzly bear direction would limit the amount of new development (such as motorized routes and developed sites) added to recreation emphasis areas. However, outside the recovery zone, new roads, trails and developed sites could be added in recreation emphasis areas. As concentrated human use areas, recreation emphasis areas could have human disturbance levels that would displace wary bears from otherwise suitable habitat. On the other hand, recreation emphasis areas would concentrate human use in smaller areas rather than dispersing human use over larger areas, which would reduce the potential for grizzly bear-human conflicts. Recreation emphasis areas are identified inside the grizzly bear recovery zone in all revised plan alternatives. With the exception of linear recreation emphasis areas associated with rivers and roads (Gallatin Canyon, Yellowstone River, and Main Boulder), recreation emphasis areas inside the recovery zone emphasize winter use, which would have minimal impacts to grizzly bears since most of the associated human use would occur when grizzly bears are denning. Winter use near a grizzly bear den site could negatively affect the bears at the den. Snowmobile use near known grizzly bear den sites is monitored under the conservation strategy, with no evidence of disturbance as yet (Montana FWP 2013a).

Podruzny and others (2002) looked specifically at potential conflicts between snowmobile use and grizzly bear den sites on the Gallatin portion of the national forest, which includes the winter recreation emphasis areas. They found that grizzly bear denning habitat is abundant, and due to the large proportion of wilderness and other areas where snowmobile use is either restricted or limited by terrain, a relatively small proportion of suitable denning habitat is vulnerable to impacts from snowmobile use.

The winter recreation emphasis areas identified inside the recovery zone in alternatives B, C and E are located near Hebgen Lake and Cooke City, where snowmobile use has been popular for many years. While these recreation emphasis areas are not identified in alternatives A and D, facilities are already in place and human use is concentrated in areas identified as recreation emphasis areas in other alternatives, which would not change in alternatives A or D. Therefore, effects of recreation emphasis area allocations would be the same under all alternatives.

Finally, forest plan allocations could influence habitat connectivity for grizzly bears outside the recovery zone by adding land use restrictions that would limit disturbance factors and habitat alterations in areas identified as potential movement corridors for bears. As noted previously, the Gallatin Range and Bridger Mountains are identified as important linkage areas for grizzly bears, with the Madison Range also indicated as a potential movement corridor (Walker and Craighead 1997, Cushman et al. 2009, Peck et al. 2017). The Gallatin to Bridger connection has been identified as a key linkage area for wildlife in Alternatives B, C and D as described above. Alternatives B and E contain no additional forest plan allocations within the key linkage area. Alternative C adds a recreation emphasis area in the Gallatin portion, and a backcountry area in the Bridger portion of the key linkage area. These forest plan allocations would have little effect on how the key linkage area is managed, since the more restrictive direction for key linkage areas would apply. Alternative D contains recommended wilderness in both the Gallatin and Bridger portions of the key linkage area, which would restrict management actions to a greater degree than plan components associated with the key linkage area, resulting in greater protection for habitat security within the key linkage area. However, under alternative D, restrictions on vegetation management tools in recommended wilderness areas could have negative consequences for wildlife movement. For example, mechanical cleanup of dense downfall after a major fire, wind event or other disturbance would be prohibited in recommended wilderness areas. Not only can major downfall impede animal movement, but heavy downfall can affect use by people of an area, causing people to move off of trails blocked by downfall into areas that would otherwise be more secure for wildlife.

Effects from Permitted Livestock Grazing Management

Grizzly bears are occasionally known to prey on livestock, which can result in removal of bears (USDI FWS 2017). Currently, livestock grazing allotments only occur on about 6 percent of the montane ecosystem geographic areas, which is where grizzly bears are known to occur, and where potential grizzly bear migration corridors have been identified. Inside the recovery zone, the number and associated acreage of livestock allotments on the Custer Gallatin have declined appreciably from the 1998 baseline. Grizzly bear direction limits the number of livestock allotments in the recovery zone, and the attractant storage direction requires proper management of livestock carcasses.

Under all alternatives, the permitted use of the active grazing allotments would likely continue at current levels of about 214,000 animal unit months across the entire national forest. Objectives for permitted livestock vary under the revised plan alternatives, from about 219,000 animal unit months annually under alternatives B and C, to 214,000 animal unit months under alternatives D and E. The higher objective under alternatives B and C reflect currently permitted levels of grazing on active allotments, plus additional capacity of roughly 5,000 animal unit months in allotments that are currently vacant. While the majority (more than 80 percent) of currently permitted livestock grazing occurs in the Ashland and Sioux Geographic Areas (outside the grizzly bear distribution area), the majority (more than 90 percent) of capacity on vacant allotments is in the Absaroka Beartooth and Madison, Henrys Lake, and Gallatin Geographic Areas, with about 28 percent of the added capacity inside the recovery zone. This means that under alternatives B and C, some currently vacant livestock allotments within the grizzly bear distribution area, both inside and outside the recovery zone, could be restocked with livestock if conditions warrant.

Since the number of currently active livestock allotments inside the recovery zone is below the 1998 baseline level, restocking of vacant allotments (with livestock other than sheep) would be consistent with the grizzly bear direction, so the objective for alternatives B and C would be the same as the current plans. The lower grazing objective for alternative D would provide animal unit months as currently permitted, while not utilizing capacity in vacant allotments to meet the (alternative D) goal of potentially closing vacant allotments for other resource purposes. The objective for alternative E would provide animal unit months as currently permitted, but acknowledges that vacant allotments likely would not be reactivated due to lower budgets for allotment and permit administration. All alternatives would be consistent with the intent of the grizzly bear conservation strategy to manage livestock grazing allotments at or below levels that existed in 1998. However, alternatives D and E would have some benefit over the other alternatives due to livestock on fewer allotments within the grizzly bear distribution area.

Improper management of livestock can damage riparian resources (White et al. 2017). Riparian areas provide foraging opportunities, water, cover, and potential movement corridors for grizzly bears and their prey species (Peck et al. 2017). All revised plan alternatives contain a goal to work with livestock permittees to relocate existing infrastructure that attracts livestock use in or near riparian areas, as well as standards and guidelines for grazing practices that avoid, minimize or mitigate negative effects of livestock use in riparian areas. The revised plan alternatives are more explicit, and ultimately more restrictive for livestock management within or near riparian areas than the existing plans, which would be beneficial to grizzly bears, both inside and outside of the recovery zone. In addition, the revised plan alternatives contain a guideline for livestock use levels that meet the forage needs of big game species on winter ranges. This component would help sustain the big game herds that contribute ungulate biomass as a key food source for grizzly bears. Revised plan alternatives would carry forward components from existing plans that are indirectly beneficial to bears, and would be more proactive in protecting riparian areas, so collectively would be better for grizzly bears than the current plans.

Effects from Energy and Minerals Management

Energy and minerals management could affect grizzly bears through reductions in secure habitat due to additional road access, or through additions of developed sites. Inside the grizzly bear recovery zone, grizzly bear plan components limit the extent of these potential effects. Even where mineral access is guaranteed by law (such as locatable minerals), grizzly bear plan components require mitigation for effects from new access or developed sites related to mineral development inside the recovery zone. Outside the recovery zone, new minerals and energy developments would have fewer restrictions; however all revised plan alternatives include desired conditions to restore site productivity following mineral activities, and include standards for reclamation to achieve the desired condition. These plan components indicate that energy and mineral management effects are temporary, and eventually areas affected are restored. However, minerals and energy development activities can last years or decades, which could have long-term impacts on grizzly bears, resulting in under use of otherwise suitable habitats. Much of the grizzly bear distribution area inside and outside the recovery zone is within designated wilderness, the wilderness study area, or inventoried roadless areas that restrict certain activities such as road building and construction of permanent facilities that would limit the amount of development associated with energy and minerals in areas suitable for grizzly bears. Effects to grizzly bears from energy and minerals management would be the same under all alternatives. The revised plan alternatives contain no plan components that would result in effects different from the current plans.

Effects from Roads and Trails, Facilities and Aircraft Management

Inside the grizzly bear recovery zone, the grizzly bear plan components dictate how roads, motorized trails, facilities and aircraft use could affect grizzly bears. Beyond the grizzly bear direction, all revised plan alternatives contain specific plan components for infrastructure including guidelines for colocation of infrastructure where possible, use of available technology to reduce resource impacts, and avoidance or minimization of impacts to water quality and riparian and wetland habitats. All revised plan alternatives state that backcountry aircraft landing strips are not suitable inside the grizzly bear recovery zone, and alternative D would prohibit backcountry airstrips across the entire national forest, which would benefit grizzly bears both within and outside the recovery zone, by effectively limiting noise and disturbance associated with aircraft landing or takeoff. Under all revised plan alternatives, plan components are complimentary to the grizzly bear direction, and would minimize effects of facilities both within and outside the grizzly bear recovery zone. Existing plans are less detailed and less restrictive, particularly relative to infrastructure within or near water and riparian areas, and are silent on backcountry aircraft use, although aircraft landing strips are addressed in the Gallatin Travel Plan, which limits this use in the grizzly bear recovery zone. Therefore, all revised plan alternatives would be more beneficial to grizzly bears than the current plans.

Effects from Recreation Developed Sites Management

Developed recreation sites include features such as campgrounds, picnic areas, visitor centers, and other facilities that accommodate concentrations of public recreation use. Use at developed sites can produce disturbance factors such as noise and people that may displace wary bears from otherwise suitable habitat. Perhaps more importantly, developed recreation sites often include facilities for preparing and eating food, and disposing of garbage, which can be an attractant for less wary bears. Bears drawn to human food sources can cause bear-human conflicts that may result in removal of the bears involved. Even if no immediate conflicts occur, bears that receive human-related food rewards may become food conditioned, reducing their natural wariness, which could lead to bear-human conflicts later, and possible management removal of the bears. Inside the recovery zone, the grizzly bear plan components limit the number and capacity of developed recreation sites. Outside the recovery zone, there is more management flexibility to build new sites or expand existing sites to accommodate more use. Proper food and attractant storage would be required in areas known to support grizzly bear use under all alternatives, but would be formally adopted as plan components under the revised plan alternatives. All revised plan alternatives include desired conditions to concentrate developed sites in existing areas rather than shifting development to new areas, and to be adaptable for resource protection. While these plan components would not prohibit new developed sites outside the recovery zone, they would ensure that new sites are designed and developed with consideration of other resources. Effects to grizzly bears would be the same under all revised plan alternatives, but stated desires and guidelines for compatibility with other resource needs could result in additional design features to minimize potential conflicts with grizzly bears to a greater degree than under the existing plans.

Effects from Recreation Events

Under all revised plan alternatives, a guideline would preclude special use permits for recreation events that involve people traveling quietly (by foot, horse, or bicycle) inside the grizzly bear recovery zone at night. Extreme race events have become more popular in recent years, and often involve activities such as hiking, running, biking, and climbing at night to increase the challenge. Grizzly bears are often active before dawn and after dusk, and are sometimes even nocturnal. Recreation events that involve people moving quietly through grizzly bear habitat in the dark increase the probability of a surprise encounter, which could trigger a bear attack. This plan component addresses an emerging issue and would do more to reduce avoidable bear-human conflicts than direction in existing plans. Aside from this addition to the revised plan alternatives, effects to grizzly bears from recreation events would be the same under all alternatives.

Cumulative Effects

Land management plans for areas adjacent to the Custer Gallatin National Forest could have cumulative effects with proposed direction for the Custer Gallatin National Forest. Greater Yellowstone Ecosystem national forests adjacent to the Custer Gallatin, including the Beaverhead-Deerlodge to the west, and the Shoshone National Forest to the southeast, have revised or amended their forest plans to incorporate habitat management direction from the Greater Yellowstone Ecosystem Grizzly Bear Conservation Strategy, making plan direction for these national forests consistent with grizzly bear direction on the Custer Gallatin under all alternatives. The Caribou-Targhee National Forest to the southwest reverts to 1997 direction, which does not directly incorporate conservation strategy recommendations, but follows Grizzly Bear Guidelines from the mid-1980s and access recommendations from the mid-1990s. It also adds specific plan components for maintaining secure habitat in certain areas, phasing out domestic sheep grazing allotments and requiring proper storage of food and attractants, which collectively, are consistent with language in the Custer Gallatin grizzly bear components, and would result in similar protections for grizzly bear habitat. Yellowstone National Park appended habitat standards to the Park Superintendent's Compendium, ensuring management consistent with the Greater Yellowstone Ecosystem Grizzly Bear Conservation Strategy, while the states of Montana, Idaho and Wyoming also incorporated regulatory mechanisms for consistency with demographic recovery criteria (USDI FWS 2017). In addition to these Greater Yellowstone Ecosystem land managers, the Helena Lewis and Clark National Forest to the north is in the process of amending their forest plan to incorporate management direction from the Northern Continental Divide Ecosystem Grizzly Bear Conservation Strategy, which is also compatible with Custer Gallatin National Forest proposed grizzly bear direction under all alternatives.

Montana Fish Wildlife and Parks manages a general hunt for bison, and a number of Tribes also conduct bison hunts on public land. Since hunting is not allowed in the national parks for either indigenous peoples or the general public, bison hunting that occurs in the Greater Yellowstone Ecosystem occurs primarily on the Custer Gallatin National Forest. Hunting of bison provides gut piles and carcass remnants, and to a lesser degree entire carcasses in the even that an animal is shot and not retrieved. Bison remnants from hunting attract grizzlies, and if managed properly, could be an important food source for grizzly bears on the Custer Gallatin in the future. Currently, any plans to allow hunting of grizzly bears as a big game species in the states of Wyoming, Idaho and Montana have been suspended with the relisting of the Greater Yellowstone Ecosystem grizzly population as a threatened species.

Conclusion

In summary, the grizzly bear direction adopted from the Greater Yellowstone Ecosystem Grizzly Bear Conservation Strategy (Yellowstone Ecosystem Subcommittee 2016) would ensure that the Custer Gallatin National Forest continues to contribute to grizzly bear recovery under all alternatives. However, compared to existing forest plans (alternative A), all revised plan alternatives would improve management for grizzly bears in a number of ways. All revised plan alternatives would provide clear, consistent grizzly bear direction and a coordinated monitoring plan for both the Custer and Gallatin portion of the recovery zone. To further emphasize the management commitment, all revised plan alternatives add a standard to maintain a special order for effective storage of food and other attractants, as well as a guideline to restrict nighttime special use recreation event activities inside the recovery zone, both of which would help to minimize grizzly bear-human conflicts and thereby reduce morality risk for bears.

In addition to grizzly bear-specific direction applied inside the recovery zone, all revised plan alternatives include plan components for other resources that would benefit grizzly bears inside and outside the recovery zone. Vegetation management components emphasize habitat composition, structure, and function within the natural range of variation to which grizzly bears have adapted over time, which would maintain habitat diversity and provide a variety of food items for grizzly bears. All revised plan alternatives would give more specific and affirmative direction for management of important grizzly bear habitat elements such as whitebark pine and riparian areas. All revised plan alternatives contain plan components for managing big game habitat, including specific direction for management of bison and bighorn sheep, which would maintain a supply of ungulate biomass as a food source for grizzly bears, and also could influence the manner in which livestock are managed, which would reduce the risk of grizzly bear mortalities associated with livestock depredations. Importantly, alternatives B, C and D specifically and proactively address habitat connectivity for wildlife, which would facilitate grizzly bear movement between ecosystems. Finally, the revised plan alternatives contain an array of forest plan allocations that vary by alternative, but would add management restrictions in most cases that would benefit grizzly bears, particularly outside the recovery zone.

Northern Long-eared Bat (*Myotis septrionalis*)

The northern long-eared bat ranges across eastern and north-central United States, to the eastern edge of Montana. If the northern long-eared bat occurs on the Custer Gallatin National Forest, it would be most likely in the Sioux and Ashland Geographic Areas. However, at the time this analysis was prepared, there were no verified occurrences of this species on the Custer Gallatin National Forest. Rangewide, the northern long-eared bat is typically found in coniferous and deciduous forested habitat during summer, and hibernating in caves, mines and other structures during winter. This species has experienced recent dramatic population declines due to the spread of white-nose syndrome, a disease that primarily affects bats in their winter hibernacula. As a result, the U. S. Fish and Wildlife Service listed the northern long-eared bat as a threatened species in April 2015 (USDI FWS 2015b, USDI FWS 2016b). In 2016, the U. S. Fish and Wildlife Service followed up with a final rule under section 4(d) of the Endangered Species Act. The 4(d) rule “prohibits purposeful take of northern long-eared bats throughout the species’ range” with few exceptions for public safety. However, incidental (unintentional) take resulting from legal activities were not prohibited (exempted) in areas not yet affected by white-nose syndrome. Areas not yet affected include those areas that are at least 150 miles from a county where there is confirmed evidence of white-nose infection in bats. Areas within 150 miles of a county with confirmed detection are considered within the white-nose syndrome zone. Critical habitat has not been designated for the northern long-eared bat, because the U. S. Fish and Wildlife Service determined that identifying such areas (known hibernacula) could actually increase the likelihood of threat from disturbance, vandalism, or introduction of pathogens (USDI FWS 2016b).

Analysis Area

Northern long-eared bats have not been positively identified on the Custer Gallatin. As mentioned previously, it may be present in the Sioux and Ashland Geographic Areas. These geographic areas are at the western edge of the species' range and also represent the extent of suitable summer habitat for the northern long-eared bat on the Custer Gallatin National Forest. Therefore, the Sioux and Ashland Geographic Areas were used as the analysis area for this species.

Affected Environment (Existing Conditions)

Although the northern long-eared bat has not yet been verified as present on the Custer Gallatin National Forest, it is relatively common in the Black Hills of South Dakota (USDI FWS 2015b), which is roughly 50 air miles southeast of the Sioux Geographic Area. The species has also recently been confirmed in Dawson County, Montana, roughly 100 air miles north of the Sioux Geographic Area (http://mtnhp.org). At the time this analysis was prepared, neither white-nose syndrome nor the fungus that causes it had yet been detected in bats on the Custer Gallatin National Forest. However, in 2018, the pathogen that causes the disease was detected in South Dakota and Wyoming, and a bat (though not a northern long-eared bat) with white-nose syndrome was found shortly thereafter in the Black Hills of South Dakota (Krake et al. 2018). While this confirmed infection was still some distance away from the Custer Gallatin, the Sioux Geographic Area is now within the white-nose syndrome zone (USDI FWS 2018), and therefore the 4(d) rule exemptions for incidental take of northern long-eared bats no longer apply in the Sioux Geographic Area.

Northern long-eared bats spend summer in deciduous and coniferous forest. The Ashland and Sioux Geographic Areas are dominated by coniferous (ponderosa pine) forest. Deciduous tree species are limited to riparian areas and woody draws, which are minor habitat components in the analysis area. In summer, northern long-eared bats use forested areas where they can find suitable roosts in trees at least 3 inches in diameter, either singularly or in colonies, under loose bark, in crevices, or in cavities of both live and dead trees. Roost trees used by maternity colonies typically range from 4 to 10 inches in diameter. Males and non-reproductive females may also roost in cooler sites such as caves or mines if available, and the species will occasionally roost in barns or abandoned buildings if trees are not available (USDI FWS 2015b). The majority of known roosts for this species have been found in hardwood tree species in eastern North America. Where roosts have been found in coniferous forest habitats, the majority of roost sites were found in snags rather than live trees, (Perry and Thill 2007). In the Black Hills of South Dakota, this species has been documented to use ponderosa pine snags for roosting (Cryan et al. 2001). Most studies to date suggest that hardwood trees are most likely to provide the characteristics of roost sites preferred by maternity colonies and groups of females bats (USDI FWS 2015b).

The Sioux and Ashland Geographic Areas are dominated by ponderosa pine forests. Recent (2012) wildfires have produced an abundance of snags, most notably in the Ashland Geographic Area. There have been numerous small fires in these geographic areas since 2012, but they have not been as large or severe. Burned snags may provide roosting habitat for bats, but generally, some degree of live tree canopy is found near roost sites (USDI FWS 2015b). In addition to green and burned ponderosa pine forest, there are smaller inclusions of deciduous trees, most notably cottonwood, aspen and green ash found in riparian areas and woody draws. Rimrock cliffs in these areas are riddled with cracks, crevices and small holes that may also provide suitable summer roosting habitat for northern long-eared bats.

Northern long-eared bats are a nocturnal, insectivorous species, feeding on moths, flies, beetles and other insects by capturing insects in flight or picking them off vegetation. Most foraging occurs within forested areas below the forest canopy, but above understory vegetation. Northern long-eared bats will also forage within small forest openings, near water and along roads (USDI FWS 2015b). Ponderosa pine forests, woody draws, and riparian areas likely provide the best foraging habitat for northern long-eared bats in the analysis area.

There are no known wintering areas for this species in the analysis area. Northern long-eared bats typically use large caves with large entrances and passages for winter hibernacula, and are often found in areas of highest humidity within the cave (USDI FWS 2015b). Caves in the Ashland and Sioux Geographic Areas are primarily wind-formed. They typically do not contain extensive passageways, and are generally dry (they lack hydrologic features and maintain low humidity). Only two small caves are known in the Ashland Geographic Area. While there are numerous small caves in portions of the Sioux Geographic Area, there are no known large caves or active or abandoned underground mines present that might serve as winter hibernacula for bats.

While there are no known winter hibernacula used by northern long-eared bats in the plan area, there are known hibernacula in the nearby Black Hills of South Dakota. Unfortunately, the fungus that causes white-nose syndrome was found in Badlands National Park in South Dakota and the Fort Laramie National Historic Site in eastern Wyoming in spring of 2018. Then, in early June 2018, a different species of bat in the Black Hills National Forest in South Dakota was confirmed to be infected with white-nose syndrome (Krake et al. 2018).

Key Stressors

The primary threat to the northern long-eared bat is from white-nose syndrome. The northern long-eared bat appears to be one of the most highly susceptible species to this disease. However, it also seems that the northern long-eared bat is less common, or even rare at the western edge of its range (USDI FWS 2015b). The bat with white-nose syndrome recently found in South Dakota was not a northern long-eared bat. Rather, it was a long-legged bat (*Myotis volans*), which is a western bat species, whereas previously this disease had affected primarily eastern bat species (Krake et al. 2018). Bats are also susceptible to other diseases such as rabies. While northern long-eared bats have been reported with rabies infection, this disease (unlike white-nose syndrome) has not been shown to have notable effects to northern long-eared bats at the population level (USDI FWS 2015b).

Human activities can affect bats, and although white-nose syndrome is transmitted primarily by bat-to-bat contact, there is some evidence that suggests that the fungal spores associated with white-nose syndrome can also be transmitted by humans. Humans are not only potential vectors of white-nose syndrome, but also can create noise and disturbance that may impact bats at summer roosts as well as in hibernacula. Such disturbance of bats infected with white-nose syndrome can often be fatal to the bats (USDI FWS 2015b).

Forest management through timber harvest and prescribed burning can alter summer habitat for northern long-eared bats, and may even cause direct mortality of bats in some circumstances; however population-level impacts generally are not expected except where the population is already affected by white-nose syndrome (USDI FWS 2015b).

Environmental Consequences

Management Direction under the Current Plans

Management direction for the Ashland and Sioux Geographic Areas is contained in the Custer forest plan. The existing Custer Plan contains no management direction specific to northern long-eared bats. However, the plan calls for conservation of threatened and endangered species through coordination with the U.S. Fish and Wildlife Service. Under the existing plan, a number of bat species (not including the northern long-eared) are identified as Forest Service or State-listed sensitive species, but with no specific plan direction for maintaining these species. Timber management direction is included to maintain a variety of tree age classes, design size and shape of individual treatment units in consideration of other resource (including wildlife) objectives, limit the size of even-aged harvest units, manage insect and disease infected timber in coordination with other resources, and to reserve snags (dead standing trees) for wildlife. The existing plan allows for a variety of management responses to wildfire, including control, contain and confine. Prescribed fire is allowed where needed to improve wildlife habitat or for other resource needs. Finally, the existing plan contains management direction to manage woody draws and riparian areas to provide for diverse vegetation and protect key wildlife habitat from conflicting uses.

Effects of the Current Plans

The primary threat to the northern long-eared bat is spread of white-nose syndrome, which primarily affects bats in winter hibernacula. Human disturbance of bats in hibernacula is also a potential threat, particularly when combined with effects of white-nose syndrome. White-nose syndrome was discovered in the United States after the current plan was developed, and there is no existing plan direction to address this threat. However, there are no known winter hibernacula used by northern long-eared bats in the Ashland or Sioux Geographic Areas, and no known caves, abandoned mines or other features that provide suitable habitat for bat hibernacula in the analysis area. Therefore, there would be no effect on hibernating bats under the proposed action.

Ponderosa pine forests, woody draws, riparian areas and rock formations provide summer roosting and foraging habitats for northern long-eared bats. Timber harvest of live trees, as well as salvage of dead trees can reduce availability of suitable roost trees, alter foraging habitat and potentially even result in direct mortality of bats if roost trees are removed when occupied by pups (young bats) that are not able to fly. Existing plan direction somewhat addresses these impacts through requirements to coordinate timber management with other resource needs, as well as size limitations on clearcuts, and snag retention in harvest units. Intermediate timber management prescriptions designed to create or maintain a variety of tree age classes could create gaps in even-aged canopies that could improve foraging habitat for northern long-eared bats. Emphasis on managing insect and disease outbreaks in timber could impact bats by reducing potential insect prey availability and snags for roosting. Prescribed burning under existing plan direction could affect summer roosting and foraging habitat in ways similar to timber harvest, except that more snags may be left behind after prescribed burning, which may provide some short-term suitable foraging habitat for bats, and may also crease suitable roost trees. Existing plan direction for fire suppression is consistent with protecting important forested roosting and foraging habitats for northern long-eared bats.

Riparian habitats and woody draws would be managed under existing direction in a manner that would maintain potential foraging areas for bats, although northern long-eared bats show a stronger foraging affinity to coniferous forest rather than riparian areas (USDI FWS 2015b). Summer roosting habitat provided by cracks, crevices and fissures in rock formations would be unaffected by management under existing plan direction.

Management Direction under the Revised Plan Alternatives

Under the revised plan alternatives, a desired condition specifies that habitat conditions that contribute to species recovery needs for all federally listed species. In addition plan components specifically address the needs of bats, including the northern long-eared bat as well as other species. All revised plan alternatives include a desired condition for maintenance of bat species diversity and key bat habitats such as winter hibernacula and maternity roosts, to be free from disturbance and disease. To this end, a standard has been added requiring agency-authorized personnel to use established decontamination procedures before entering any known winter bat hibernacula to prevent the spread of disease. A whole suite of guidelines were added to maintain vegetation conditions that may contribute to microclimates within known bat hibernacula, protect maternal roost sites, avoid adding human disturbance in key habitats, avoid removal of facilities when bats are present, and use bat-friendly methods when closing caves or mines for human safety. Also, a guideline is added to protect bats and birds from mortality risk associated with new wind energy developments.

Effects of the Revised Plan Alternatives

The revised plan alternatives specifically address the threat of white-nose syndrome by requiring all Forest Service employees and agency-authorized personnel such as contractors, researchers and permittees to use established white-nose syndrome decontamination procedures prior to entering caves, abandoned mines, or other features known to be used as winter hibernacula by any bat species. Even though there are no known winter hibernacula used by northern long-eared bats on the Custer Gallatin, there are known hibernacula used by other bat species outside the range of the northern long-eared bat. Bat species are often communal at winter hibernacula, with multiple species present in the same sites. Most bat species show some degree of fidelity to winter hibernacula (return to the same site each year), but may move to another hibernacula under certain conditions (Johnson and King 2018). Also, some bats can be carriers of the fungus that causes white-nose syndrome, but are not affected by the disease. Movement of bats between hibernacula may not be frequent, but could further the spread of white-nose syndrome. By minimizing potential for human introduction of disease into bat hibernacula, plan components in all revised plan alternatives would reduce the risk of white-nose syndrome spreading between hibernacula on the Custer Gallatin and hibernacula used by northern long-eared bats.

All revised plan alternatives include proactive measures to minimize human disturbance of bats at maternity and general roost sites. These measures would reduce the risk of bat mortality associated with removal of maternity roost sites when juvenile bats are present and would reduce disturbance at other roost sites, which would avoid negative effects caused by increased energy demands for bats having to relocate and find another suitable roost site. Measures would mitigate for loss of potential roosting areas and hibernacula by encouraging replacement or bat-friendly closure devices that would allow continued use by bats.

Finally, all revised plan alternatives would address potential effects of wind energy development on northern long-eared bats and other bat species. Wind energy turbines can cause displacement, injury or fatality of bats through changes in air pressure as well as actual collisions with wind turbine blades. Construction of new wind energy facilities can alter habitat if located within or near forested habitats, if tree clearing is needed for placement of, or access to, wind energy facilities. All revised plan alternatives include a guideline to locate and design new wind energy developments to minimize impacts to bats.

Consequences to Northern Long-Eared Bats from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Fire and Fuels Management

Prescribed burning can alter bat habitat by reducing live tree cover, but many snags are typically left behind, which may provide some suitable foraging and roosting habitat for bats. Bats have evolved with fire, and prescribed fire can benefit bats by creating snags, increasing insect forage base, and creating small openings in forest canopies. Depending on the timing of the burns, there is potential for negative impacts as well, particularly if burns occur when and where maternity colonies are present. Wildfires could have similar impacts to prescribed burns, although natural ignitions typically occur later in the summer, often after young bats are able to fly independently (USDI FWS 2015b). All revised plan alternatives include desired conditions that support natural fire regimes allowing wildfires to burn within a natural range of intensity, severity and frequency, but with special consideration for sensitive habitats of at-risk species. Both wildfire and prescribed burning would be used as tools to keep vegetation conditions within, or move them toward, the natural range of variation to which bat species, including the northern long-eared bat, have evolved.

Effects from Timber Management

Forest management through timber harvest can alter summer habitat for northern long-eared bats by removing suitable roost trees or snags, as well as changing forest structure and canopy cover. In addition to habitat alteration, forest management can have disturbance impacts if bats are roosting in the vicinity, and although many bats could likely flee such disturbance and survive, there is potential for direct mortality of bats if an occupied roost tree is felled, particularly if there are young, flightless or inexperienced bats present (USDI FWS 2015b). Under all revised plan alternatives, plan components would limit mechanical tree removal within a prescribed distance of known winter hibernacula in order to maintain vegetative conditions that may be associated with microclimates important to bats inside hibernacula. Plan components would also prohibit the removal of known bat maternal roost trees during the pup season, and limit disturbance nearby. Vegetation management guidelines increase the number of snags that should be left in timber harvest units, with an emphasis on leaving the largest snags, compared to existing plans, and also promote retention of larger trees (at least 15 inches in diameter or larger). Large trees and snags are preferred roost sites for bats (Ibid).

Effects from Cave Management

Management direction for cave and karst resources is located in the Energy, Minerals and Geologic Areas of Interest section of the plan. See the Energy, Minerals and Geologic Areas of Interest section of this document for further analysis of cave and karst resources. All revised plan alternatives include desired conditions that cave resources are available for public enjoyment, but also provide wildlife habitat requirements of stress-free and disease-free conditions for vulnerable cave-associated species, such as northern long-eared bats and other bat species. Plan components in the current Custer Plan and the revised plan alternatives restrict management actions that could damage cave resources, such as logging, road construction, and other uses of heavy equipment above or near cave entrances. These measures would protect cave microclimates that contribute to suitability as roost sites or hibernacula, and also limit disturbance impacts near potential roost sites and hibernacula.

Effects from Recreation Management

Most bat species including the northern long-eared bat, are highly nocturnal, and are therefore less affected by daytime recreational use than other wildlife. The exception is recreational caving, which can disturb roosting or hibernating bats, with potentially serious impacts associated with increased energy demands when bats are roused from rest or hibernation. There are no known winter hibernacula or colonial roost sites used by northern long-eared bats in the analysis area, so effects from recreation would be minimal under all revised plan alternatives. However, should northern long-eared bats be found in the future, all revised plan alternatives include a guideline that new developed recreation sites, including roads, trails, campgrounds, and picnic areas, should not be located near known bat hibernacula or maternal roost sites.

Cumulative Effects

The Black Hills National Forest in South Dakota is within the range of northern long-eared bats, and there has been documented occurrence of white-nose syndrome on a different species. The Black Hills forest plan (as amended 1997) contains direction for bat-friendly cave and mine closures, management of roosts and hibernacula, which are consistent with plan components in the revised plan alternatives.

The Miles City and South Dakota Field Offices of the Bureau of Land Management also manage land within the range of the northern long-eared bat. While neither resource management plan contains specific management measures for the northern long-eared bat, the South Dakota Plan contains general bat protection measures. The Miles City Field Office Resource Management Plan contains resource protection measures, best management practices, no surface occupancy, and controlled surface use stipulations designed to minimize disruption of habitat and limit disturbance within and near bat habitat.

The South Dakota State Wildlife Action Plan identifies the northern long-eared bat as a species of greatest conservation need. Although the State Wildlife Action Plan does not show Custer Gallatin lands in South Dakota as occupied by this species, it identifies conservation actions such as minimizing disturbance at roost sites and hibernacula, and use of bat-friendly devices for closure of caves and abandoned mines, which are compatible with plan components contained in the revised plan alternatives.

Conclusion

Northern long-eared bats have not yet been documented to occur on the Custer Gallatin Forest, and only a small portion of the Custer Gallatin is within the species' range. However, all revised plan alternatives include a suite of plan components to specifically address land management issues for all bat species known to occur here. These plan components address factors of most concern for northern long-eared bats such as disease transmission, and disturbance at roost sites and hibernacula. Therefore, the revised plan alternatives would contribute to conservation of multiple bat species, including the northern long-eared bat, to a greater degree than existing plans.

Wolverine (*Gulo gulo*)

The wolverine is the largest land-dwelling member of the weasel family (USDI FWS 2013b). With large, flat feet, a compact body and a thick, insulated coat of fur, the species is well adapted to live in cold, snowy conditions. As such, the species occurs throughout arctic and subarctic regions, as well as boreal forests in Eurasia and North America (Copeland et al. 2010). In North America, they are found primarily in tundra, taiga, and subalpine habitats, which at southern latitudes, occur as extensions into the contiguous United States, and as such, these habitats are naturally more fragmented than core habitat further north in Canada and Alaska. As a result of this habitat patchiness, wolverine populations occur at lower densities in the continental United States, (Ruggiero et al. 2007). Wolverine habitat in the lower 48 states is typically found at higher elevations, generally above 2,100 meters (6,800 feet). It is likely that wolverines select higher elevation habitats to avoid high temperatures in summer (USDI FWS 2013b). Additionally, high elevations provide deep snow that persists well into spring months, a condition crucial to females in the selection of reproductive den sites (Ruggiero et al. 2007).

Female wolverines may be capable of giving birth at two years of age, but the average age at first reproduction is likely three years. Breeding typically takes place in late summer to early fall, but implantation of fertilized eggs is delayed until winter. Kits are born in February or March, with an average litter size of one or two (USDI FWS 2013b). Once kits are weaned in late April or May, the natal den is usually abandoned, (Copeland et al. 2010). Although most female wolverines are capable of annual reproduction, high energetic demands associated with pregnancy in a harsh, unproductive environment, result in loss of pregnancy for about half the reproductive population each year. Consequently, wolverines have one of the lowest reproductive rates of any mammal (USDI FWS 2013b). The combination of naturally fragmented habitat, low productivity in the environment, and low reproductive rates, result in very sparse population densities for wolverines on the Custer Gallatin and elsewhere across their range (Inman et al. 2013).

Wolverines employ the foraging strategy of an opportunistic omnivore, feeding on a variety of food sources, based on availability. Wolverines are primarily scavengers, seeking out carrion from ungulates that died of natural causes, or carcasses left behind by other predators. While they are capable of taking live prey larger than themselves, wolverines typically prey on small mammals and birds. They will also consume insects, berries, and other fruity plants if available (USDI FWS 2013b). This adaptive foraging strategy allows wolverines to persist in an otherwise hostile (for example cold, unproductive) environment (Inman et al. 2013).

Home range sizes for most mammals are associated with body size, and individuals living in less productive habitats typically have larger home ranges. This association holds true for wolverines, as inhabitants of harsh, relatively unproductive environments, their home range size is large relative to their body mass. Home range sizes for wolverines in the Greater Yellowstone Ecosystem, which includes the Custer Gallatin National Forest, average about 303 square kilometers (117 square miles) for independent females (for example, without young), and about 797 square kilometers (308 square miles) for adult males. Females with dependent young still have fairly large annual home range size at roughly 100 square kilometers (39 square miles). Minimal overlap (typically less than 2 percent) between home ranges of adult wolverines of the same sex indicates territoriality. Finding adequate resources and maintaining large territories requires long-range movements. Males travel two to three times further than females on average, but both sexes frequently move distances equivalent to the diameter of their home range in just a couple of days, often covering a distance equal to the perimeter of their home range in less than a week. Juveniles disperse from their mother's home range, starting at about eleven months of age. Genetic profiles of different wolverines indicate that dispersals of up to 500 kilometers (310 miles) are possible, (Inman et al. 2011).

Given the natural patchiness of wolverine habitat, coupled with the species' capacity for long-range movement, it is likely that wolverines in the lower 48 states exist as a metapopulation, which is basically a network of subpopulations occupying isolated patches of suitable habitat, separated by sometimes vast expanses of unsuitable habitat, but that occasionally interbreed through dispersing or wandering individuals (USDI FWS 2013b). Due to the wolverine's selection of remote, harsh environments and associated low density occurrence on the landscape, population demographics are difficult to monitor. However, what is clear is that their persistence in the naturally fragmented habitat found on the Custer Gallatin and elsewhere at the southern edge of their range, is vitally dependent upon regular, or at least intermittent, dispersal of individuals between habitat islands to facilitate gene flow between sub-populations (Ruggiero et al. 2007). Significant genetic diversity has been found in between subpopulations of wolverines, indicating low migration rates and at least some degree of geographic isolation between subpopulations, (Aubry et al. 2007). Male-dominated dispersal and female tendencies to remain closer to their birth areas are thought to contribute to this genetic structuring of wolverine populations, (Squires et al. 2007).

Until recently, wolverines were one of the least-studied carnivores in North America, particularly in the continental United States, which has very low density populations that are difficult to monitor. The species was petitioned for listing at the turn of the 21st century, which prompted new research on wolverine distribution, ecology, and interactions with humans (Ruggiero et al. 2007). Even with this new research, there is no reliable historic or current population census for wolverines in the continental United States, so there is uncertainty in population trend estimates; however, it is widely accepted that wolverine densities are naturally low in the lower 48 states. The U. S. Fish and Wildlife Service reviewed potential threats to wolverines in the contiguous United States and found that the species met the criteria for a threatened species due to the likelihood of habitat loss caused by climate change resulting in population decline and possible breakdown of metapopulation dynamics. They identified the wolverine in the contiguous United States as a distinct population segment, and proposed to list this distinct population segment of the North American wolverine as threatened under the Endangered Species Act (USDI FWS 2013b). At the time this analysis was prepared, no final rule had been issued for this species.

Analysis Area

Wolverines occur in the montane ecosystem of the Custer Gallatin National Forest. This ecosystem, which includes the Madison, Henrys Lake, and Gallatin Mountains; Absaroka Beartooth Mountains; Bridger, Bangtail, and Crazy Mountains; and Pryor Geographic Areas, constitutes the analysis area used for indirect effects to wolverines. However, wolverines that occur on the Custer Gallatin are members of subpopulations of animals in which individuals may come from, or disperse to, areas outside the Custer Gallatin Forest boundaries. Therefore, science considered in this section, and a cumulative effects analysis area expands beyond the national forest boundary to include the entire Greater Yellowstone Area.

Affected Environment (Existing Conditions)

On the Custer Gallatin, wolverines that occur in the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas are part of the Greater Yellowstone subpopulation. These geographic areas contain large, contiguous blocks of high elevation habitat with persistent spring snow, and low levels of human disturbance. The Greater Yellowstone Ecosystem has been identified as one area in the continental United States that is predicted to experience less snow loss due to climate change than other areas at lower elevations, (McKelvey et al. 2011). Another area for wolverines has been coined the “Central Linkage Region” by Inman and associates (2013). This region includes the Bridger, Bangtail, and Crazy Mountains Geographic Area, which could be highly important for wolverine metapopulation persistence, because its position on the landscape may provide habitat connectivity and linkage between large contiguous blocks of suitable wolverine habitat to the north and south. Collectively, the Central Linkage Region is roughly the same scale as the Greater Yellowstone Region for wolverines, but habitat is much more patchily distributed, primarily on public lands at higher elevations within the mountainous areas, which are separated by intervening valley bottoms and lowlands, much of which are held in private ownership, (Inman et al. 2011). The Pryor Geographic Area has some, albeit very marginal quality wolverine habitat. This is the only geographic area in the montane ecosystem for which wolverine presence has not been documented, and that does not contain adequate primary habitat for wolverines. However, Inman and others (2013) noted that the Pryor Geographic Area may serve as dispersal habitat, primarily for male wolverines.

The U. S. Fish and Wildlife Service determined that wolverines in the continental United States represent a distinct population segment, and estimated the current wolverine population at somewhere between 250 to 300 individuals (USDI FWS 2013b). The Greater Yellowstone and Central Linkage subpopulations are believed to contain a considerable proportion of wolverines found in this distinct population segment, with an estimated 63 individuals in the Greater Yellowstone Area, and about 50 animals in the Central Linkage Region (Inman et al. 2013). No estimate is available for the number of wolverines that occupy the Custer Gallatin portion of these areas. However, estimates at the larger landscape scale equate to roughly 3.5 wolverines per 1,000 square kilometers (386 square miles) of suitable habitat (ibid.). Based on criteria developed by Inman and associates (2013), the Custer Gallatin contains roughly 2,731 square miles of habitat suitable for residential occupation (maternal and primary habitat combined). Accordingly, if suitable habitat on the Custer Gallatin were fully occupied, one would expect approximately 25 wolverines to occur in the plan area.

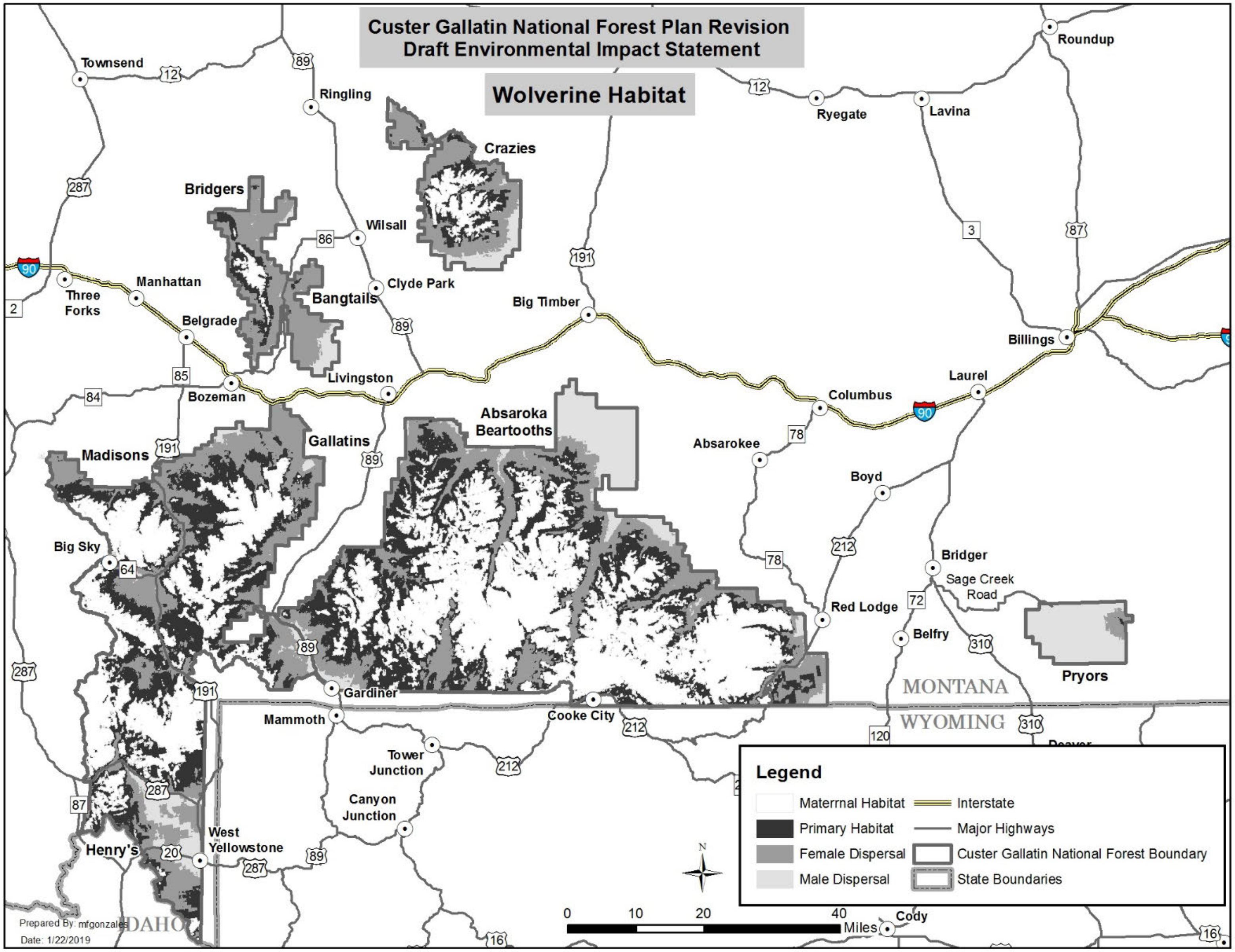

Figure 36. Custer Gallatin wolverine suitable habitat for residential occupation

The best available scientific information indicates a very strong association between wolverines and cold temperatures, persistent snow conditions, and relatively high elevations across the landscape (Aubry et al. 2007, Ruggiero et al. 2007, Copeland et al. 2010, Inman et al. 2011, 2013, and McKelvey et al 2011). Whereas wolverines appear to be habitat generalists in terms of vegetative conditions, cooler temperatures in both summer and winter, along with deep snow that persists well into spring, appear to be key habitat components for this species. These conditions provide an ecological niche in which wolverines can avoid competition for resources with other predators. Snow is also seemingly crucial to wolverine reproductive habitat, in that the vast majority of known reproductive den sites worldwide are associated with deep snow conditions that provide thermal insulation as well as protection from predators for wolverine kits. Snow and cold are also thought to play a role in the wolverine's foraging strategy in that they are known to scavenge winter-killed ungulates such as mountain goats, and cache food in the snow for long-term use. On the Custer Gallatin, the Bridger, Bangtail, and Crazy Mountains, Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas all maintained persistent spring snow (Copeland et al. 2010).

Wolverines on the Custer Gallatin and surrounding areas show most consistent use at elevations of at least 2,600 meters (8,530 feet) and tend to avoid areas below 2,150 meters (7,050 feet) in elevation. They are typically found at or above tree line in summer and shift to slightly lower elevations, usually right around tree line, in winter. Although wolverines move to slightly lower elevations in winter, they still tend to stay above 2,450 meters (8,040 feet) and may even range up to 3,050 meters (10,000 feet). This elevation band is well above the areas that typically provide winter range for most big game species, where large concentrations of elk and other species provide abundant scavenging opportunities. At these high elevations, snow persists in patches well into the summer months, lending to a very brief growing season and resulting in low vegetative productivity. Wolverines have apparently adapted to a trade-off between highly productive environments and low predation risk and competition from other predators (Inman et al. 2011). Since wolverines select habitat that is remote, and therefore generally uninviting for human use and occupation, there has been limited overlap between permanent human developments and high human use areas with primary wolverine habitat. The exception on National Forest System lands is developed ski areas, of which there are two alpine areas, Bridger Bowl in the Bridger, Bangtail, and Crazy Mountains Geographic Area, and Red Lodge Mountain in the Absaroka Beartooth Mountains Geographic Area, as well as two Nordic areas, the Crosscut Mountain Sports Center in the Bridger, Bangtail, and Crazy Mountains Geographic Area and the Lone Mountain Ranch in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area. These areas include maintained ski lifts, runs and small buildings on National Forest System runs, and facilitate concentrated winter recreation that may have localized effect on wolverine habitat suitability.

Genetic structuring among wolverine subpopulations supports a theory that higher elevations and associated snow cover is important for wolverine dispersal as well, indicating that successful dispersals were linked to paths within areas of persistent snow cover (Copeland et al. 2010; McKelvey et al. 2011). With large, flat feet, a compact body, and a thick, insulated coat of fur, the wolverine is well adapted to live in cold, snowy conditions, and accordingly, it is not surprising that snow conditions influence travel (Inman et al. 2011). Parks and others (2012) reported that wolverines from the Greater Yellowstone Area showed limited genetic connectivity to the rest of the Continental United States distinct population segment. They suggested that geographic isolation of the Greater Yellowstone subpopulation is due to conditions associated with connecting corridors, which tend to be long, linear areas located at lower elevations, frequently crossing areas of human development. Potential dispersal routes for wolverines have been identified based on models that predict persistent spring snow cover,(Schwartz et al. 2009b), (McKelvey et al. 2011). Based on these projections, the most prominent potential wolverine dispersal paths on the Custer Gallatin include a route between Yellowstone Park and the Absaroka-Beartooth Wilderness, with fading importance up through the Crazy Mountains to the north. Another prominent path goes from the south end of the Gallatin Range, up through the north end of the Madison Range (ibid). In addition to these areas, Inman and others (2013) modeled wolverine habitat selection based on known locations of radio-collared wolverines, and concluded the entire Central Linkage Region, which includes the Bridger and Bangtail ranges as well as the Crazy Mountains, is important for habitat connectivity and wolverine dispersal.

Wolverines are capable of long distance movements, including travel through human developments and otherwise altered habitat, but appear to prefer to move across suitable habitat, and minimize travel through low elevation habitats (U.S. Department of the Interior 2013b, Halofsky et al. 2018b). Iman and others (2013) noted that there is no evidence that wolverine dispersal is currently being restricted by human development to a degree that negatively affects metapopulation functionality. However, they also cautioned that there may be a limit to the wolverine’s willingness and capability to travel through increasing human development.

Copeland and associates (2010) used satellite imagery to build a coarse filter map of potential wolverine habitat on a global scale, by indicating where snow was consistently present through the end of the reproductive denning season (approximately through May 15). Inman and others (2013) then produced a more fine-scale resource selection model to predict habitat suitability for wolverine survival, reproduction and dispersal. Results from these two models were a good match to known wolverine distribution for the Custer Gallatin National Forest, so parameters from these two models were used to quantify, evaluate and display potential wolverine habitat within the plan area (figure 36). Approximately 62 percent of the geographic areas that make up the montane ecosystem of the Custer Gallatin was modeled to have persistent snow coverage as defined by Copeland and others (2010). Research indicates that a pattern of reduced spring snowpack in wolverine habitat has been in place since at least the 1950s (McKelvey and Buotte 2018 in Halofsky et al. 2018b), but there is little information as to whether, or how this pattern has affected wolverine habitat on the Custer Gallatin. Winter use does not necessarily affect the amount or persistence of spring snow, but noise and human presence during winter can affect wolverine use of habitat. Large portions of wolverine habitat are within designated areas that restrict the type of human use allowed in summer and winter. In addition, the Gallatin Travel Management Plan imposed snowmobile closures in some areas of suitable wolverine habitat.

Ninety-four percent of wolverine habitat in the contiguous United States is in federal ownership, most of which is managed by the Forest Service. Of that, a considerable portion is found in protected areas, with roughly 33 percent in designated wilderness and 16 percent in inventoried roadless areas (USDI FWS 2013b). On the Custer Gallatin, approximately 87 percent of wolverine habitat is on National Forest System lands. Similar to the national statistics, much of the wolverine habitat on the Custer Gallatin is within designated areas, including approximately 43 percent in designated wilderness, and another 33 percent in designated wilderness study area and inventoried roadless areas combined.

Inman and associates (2013) used empirical data from wolverine studies in the vicinity of the Custer Gallatin Forest to classify habitat into categories that are biologically meaningful to wolverines as well as pertinent to land management considerations. Generally, these categories included habitat that is suitable for wolverine reproduction, survival. And dispersal. Maternal habitat includes those areas that are suitable for use by reproductive females because they contain habitat components associated with known maternal den sites and kit-rearing rendezvous sites. Primary habitat includes maternal habitat, but expands further, to include those areas suitable for long-term survival use by resident male and female wolverines. Primary habitat contains foraging opportunities as well as relatively secure habitat where wolverines can escape danger, shelter from weather elements, and avoid disturbance. Dispersal habitat includes both maternal and primary habitat, but also includes lower quality habitat that can be use by dispersing wolverines to move between patches of primary habitat. Since male wolverines tend to disperse further than females, male dispersal habitat is generally inclusive of all other wolverine habitat components. Table 62 shows the proportions of various wolverine habitat components by wolverine subpopulation.

Table 62. Wolverine habitat[1] summary – all ownerships

Geographic Area Size in Acres	Persistent Snow	Maternal	Primary	Female Dispersal	Male Dispersal
AB + MHG: GYA Region 2,340,637	1,545,298 66%	914,627 39%	1,648,336 70%	2,185,244 93%	2,340,514 100%
BBC: Central Link Region 314,598	150,238 48%	37,433 12%	98,828 31%	274,616 87%	314,598 100%
Pryor Mountains 77,944	14,982 19%	0 0%	391 <1%	7,391 9%	77,944 100%
Total 2,733,179	1,710,518 62%	952,060 35%	1,747,555 64%	2,467,251 90%	2,733,056 100%

1. Source: Inman et al. 2013

Maternal and primary habitat are the most important areas for wolverines and are strongly tied to areas of persistent snow cover. These areas overlap to a considerable degree with designated wilderness and inventoried roadless areas, at least partly due to their locations in high elevation, remote landscapes. Sixty-seven percent of maternal wolverine habitat on the Custer Gallatin is within designated wilderness, with an additional 28 percent in inventoried roadless area, for a total of 95 percent of maternal habitat in some form of protected area that is not expected to change. Primary wolverine habitat, which includes maternal habitat, is also well-protected with existing designations, including 57 percent in wilderness, and an additional 32 percent in inventoried roadless areas, for a total of 89 percent of primary habitat.

Due to the wolverine's strong association with the amount, distribution, and persistence of snow cover, the potential for impacts to the species due to past, ongoing and future changing climate is considerable (Copeland et al. 2010, McKelvey et al. 2011, Inman et al. 2013, USDI FWS 2013b, McKelvey and Buotte 2018). Continuing impacts could result from loss of snowpack for reproductive den sites, warmer temperatures affecting the wolverine's capacity for thermoregulation, lack of snow and cold for preserving food caches, and loss of habitat connectivity for dispersal and subsequent impacts to genetic diversity (Copeland et al 2010). McKelvey and associates (2011) used sophisticated modeling techniques to predict climate change impacts to wolverine habitat, resulting in expected shifts in wolverine distribution and connectivity by the end of the 21st century. This study identified the Greater Yellowstone Region, where the majority of suitable wolverine habitat on the Custer Gallatin National Forest is located, as an area likely to sustain persistent snow cover in coming decades. These authors also predicted that important corridors connecting the Greater Yellowstone wolverine subpopulation to other core areas in northwest Montana would shift to the east. If this prediction is correct, the Bridger, Bangtail, and Crazy Mountains Geographic Area on the Custer Gallatin may become even more important for wolverine habitat connectivity associated with the Central Linkage Region. There is convincing evidence that the climate is changing in ways that could affect snow accumulation, which may influence the distribution of wolverines. However, the precise nature of such impacts, including the degree of causality between climate change, habitat conditions and wolverine response, are quite speculative (USDI FWS 2014b).

Key Stressors

In the 20th century, wolverines were extirpated or nearly so, from the continental United States by the 1930s due to unregulated trapping and predator control (Aubry et al. 2007, USDI FWS 2013b). As wolverines became reestablished around the mid-20th century (Aubry 2007), Montana was the only state in the lower 48 to allow trapping of the species. In 2012, the legal harvest of wolverines in Montana was essentially halted, and the season has remained effectively closed with a harvest quota of zero (USDI FWS 2013b).

In the 21st century, climate change was identified by the U. S. Fish and Wildlife Service as the primary threat to the distinct population segment of wolverines in the continental United States (USDI FWS 2013b), yet they found that although reductions in spring snow cover have already been recorded in portions of the wolverine's range, the best available science does not show any notable shrinkage of wolverine habitat thus far (USDI FWS 2014b).

Other potential stressors identified for this analysis include resource extraction activities such as timber harvest and mining, roads and associated human access and rural sprawl, all of which may have potential to impact wolverines and their habitat (Ruggiero et al. 2007, Inman et al. 2011).

Given the strong association between wolverine habitat and snow cover, winter recreation uses such as skiing and snowmobiling may also be key stressors for this species.

Environmental Consequences

Effects Common to All Alternatives

Under all alternatives, the amount and distribution of Congressionally-designed wilderness and inventoried roadless areas would not change (see designated areas section of the draft environmental impact statement for further discussion and assumptions made about changes over time.) Effectively all of the primary and maternal habitat for wolverines on the Custer Gallatin National Forest is located in the Absaroka Beartooth Mountains, Madison, Henrys Lake, and Gallatin Mountains and Bridger, Bangtail, and Crazy Mountains Geographic Areas. The amount of primary habitat in the Pryors (391 acres) is less than one-tenth of one percent. Seventy percent of the National Forest System land in the Absaroka Beartooth Mountains, Madison, Henrys Lake, and Gallatin Mountains and Bridger, Bangtail, and Crazy Mountains Geographic Areas (collectively) is primary wolverine habitat. Over half (56 percent) of the primary habitat is also suitable for maternal use. Seventy-nine percent of the National Forest System lands in these geographic areas falls within designated wilderness, wilderness study area, or inventoried roadless area, and there is considerable overlap between these designations and wolverine primary or maternal habitat. Therefore, under all alternatives, the vast majority of primary or maternal wolverine habitat on National Forest System lands would remain within designed wilderness and inventoried roadless areas.

National Forest System lands provide vegetation conditions that help mitigate greenhouse gas influence on climate change. Under all alternatives, land management actions that affect vegetation composition and function would occur at a very small scale relative to the land base that supports natural ecosystem processes (see Carbon Storage and Sequestration section of the draft environmental impact statement for more detailed discussion of this topic). Therefore, land management actions are very unlikely to have a notable impact on climate change. Forest management actions that reduce or remove vegetation cover, such as timber harvest, road construction and prescribed fire, can impact soil temperature, snow interception and retention of snowpack (Luce 2018 *in* Halofsky et al. 2018a). However, such actions would occur at a very small scale relative to suitable wolverine habitat on the Custer Gallatin, and even relative to the home range size of an individual wolverine. Also, the majority of wolverine use, including reproductive denning, occurs at elevations over 8,000 feet (Inman et al. 2011) where vegetation management and roading are unlikely to occur. Finally, a large proportion of suitable wolverine habitat is in designated areas where such actions are not allowed, or are allowed under limited circumstances, and these designated areas would be the same under all alternatives. Therefore, management actions under all alternatives are unlikely to have a notable impact on persistent spring snow cover in primary wolverine habitat.

While the majority of wolverine use occurs at high elevations, the metapopulation structure is dependent on dispersal of individuals to facilitate gene flow between subpopulations (Ruggiero et al. 2007). Wolverines are capable of long distance movements, including travel through lower elevation habitats and human developments, but appear to prefer areas with persistent spring snow as dispersal routes (McKelvey et al. 2011, USDI FWS 2013b). In lower elevations where land management and general human use is more prevalent, management actions on National Forest System lands that remove or reduce vegetative cover (such as timber harvest and prescribed fire), as well as those that remove or reduce snow (such as plowed roads) can affect wolverine dispersal habitat, but under all alternatives, would occur at very low levels relative to the scale at which wolverines operate, particularly dispersing animals.

Winter recreation likely has little effect on snow persistence at high elevations, but could have minor impacts in wolverine dispersal habitat, particularly in areas where roads are plowed to facilitate access for winter use. Very few Forest Service roads are plowed in winter. Winter use that results in snow compaction, such as snowmobiling, skiing, and grooming routes for these activities, may actually increase the length of time snow is present in compacted areas versus areas where snow is not compacted. However, under all alternatives, snow compacting activities are limited by lynx management direction, and the scale at which snow-compacting activities is expected to occur is small relative to a wolverine’s home range size.

Although winter use is not expected to have notable effects on snow persistence at high elevations, winter use, particularly backcountry use that overlaps with wolverine maternal or primary habitat, can have disturbance effects that may cause individual wolverines to alter normal behavior patterns, which can result in increased energy demand during a time when maintaining energy reserves is critical for wolverines. Heinemeyer and associates (2017) studied effects of winter recreation on wolverines in the Greater Yellowstone Area, including parts of the Custer Gallatin Forest. They found that wolverines responded to backcountry winter use in different ways, but given the extent of overlap between winter recreation and wolverine distribution, suggested that wolverines tolerate winter recreation to some degree. In this study, wolverines reacted negatively to higher levels of recreation use in winter, with stronger responses to dispersed use than to use on designated routes, indicating that wolverines may have a higher tolerance for more predictable patterns of winter recreation use. Wolverines reacted to both motorized and nonmotorized winter recreation. However, since motorized equipment allows humans to travel further (and faster than nonmotorized means of transport), motorized winter recreation could affect larger proportions of wolverine habitat.

Developed ski areas on National Forest System lands are areas of concentrated winter recreation use that are likely avoided by wolverines since wolverines tend to respond more negatively as intensity of winter recreation increases (Heinemeyer et al. 2017). The four existing ski areas on the Custer Gallatin National Forest could potentially be expanded under all alternatives, which would further reduce suitable winter habitat for a small number of wolverines with home ranges that overlap the ski areas. However, under all alternatives, expansion of existing permitted ski areas would be favored over development of new areas. Concentrating use in areas already avoided by wolverines would have less impact than authorizing new development in areas that are relatively secure.

Winter access to National Forest System lands facilitates fur trapping. Montana’s fur trapping season for wolverines has been effectively closed since 2012. However, as a dietary generalist with a winter foraging strategy focused on scavenging animal carcasses, wolverines may be attracted, and vulnerable to capture in traps set for other fur-bearers. Since the trapping season for wolverines was closed in 2012, there has been only one record of an incidental (unintended) trapping of a wolverine on the Custer Gallatin that resulted in a wolverine mortality (R. Inman, Montana FWP, 2018 pers. comm.). Therefore, fur trapping in general would present a negligible indirect effect to wolverine populations in the plan area.

Management Direction under the Current Plans

Neither the Custer nor Gallatin existing plans provide direction specifically addressing wolverines or their habitat. However, both plans contain general direction for maintenance of wildlife habitat in coordination with other management actions. Under the existing plans, management direction for lynx provides guidance that can restrict winter use that results in snow compaction. The wolverine is on the Regional Forester’s list of sensitive species and both plans contain generic language that habitat will be maintained in a suitable condition to support regionally designated sensitive species. Direction for management of sensitive species is contained in the Forest Service Manual (FSM) and was therefore not repeated in the forest plans. The Gallatin Forest Plan cites potential need for developed ski area expansion and states that existing ski areas will be given priority before any new proposals for downhill ski areas are considered. The Custer Forest Plan indicates the need for possible expansion of the Red Lodge Mountain Ski Area, and refers to the approved master plan for direction specific to ski area management.

Effects of the Current Plans

Under the current plans, forest management would continue with no specific forest plan direction for wolverines, but new management actions would continue to address potential impacts to wolverine as a Regional Forester’s sensitive species, per direction to coordinate management actions with wildlife habitat needs. Vegetation management would continue at similar levels, with very minor impacts to wolverine habitats that generally occur at higher elevations where vegetation management is seldom targeted. Dispersed winter recreation would continue at similar or increasing levels, as the human population grows and associated visitor use increases. Use at existing permitted ski areas (including 2 alpine and 2 Nordic areas) could be expanded to cover larger areas. While such expansion could affect individual wolverines in those areas, expanding use near existing areas would have less impact on wolverines than adding new ski areas, thus concentrating use in areas that currently get relatively low levels of dispersed use. Under the current plans, there would be no new restrictions on winter use, which would allow for more use by the general recreating public, as well as additional outfitter and guide permits for winter recreation. Increasing intensity and distribution of winter recreation use could have negative impacts on individual wolverines.

Management Direction under the Revised Plan Alternatives

Similar to the current plans, all revised plan alternatives include a desired condition that habitat contribute to species recovery needs and that population trends of listed species are stable or increasing across their range. In addition, the revised plan alternatives contain desired conditions for vegetation that is within the natural range of variation to provide habitat conditions similar to those with which species have evolved, and landscape patterns that provide habitat connectivity for wildlife. The revised plan alternatives also include a specific desired condition that the forest and alpine habitat characterized by persistent snow cover and cooler temperatures provide high quality reproductive habitat, denning and foraging opportunities for wolverines, and that high elevation habitat and associated microclimates provide refugia and habitat connectivity for wolverines in the face of changing climates. A guideline in the revised plan alternatives to provide secure habitat for reproductive wolverines by limiting special use authorizations and designation of winter routes in maternal habitat during the reproductive season. Finally, alternatives B, C, and D implement a key linkage area concept, with plan components that limit management actions.

Effects of the Revised Plan Alternatives

Winter time human disturbance at or near wolverine reproductive den sites has been documented to result in den abandonment. However, such incidents appear rare, and there are also reported incidents of human disturbance at den sites that were not abandoned (USDI FWS 2013b). Plan components in the revised plan alternatives would reduce potential for human disturbance in maternal habitat relative to the current plans.

The key linkage area established in alternatives B, C and D would minimize habitat loss due to construction of permanent facilities, and limit disturbance effects due to larger-scale management actions in focal areas at the north end of the Gallatin Range and the west side of the Bridger Range. The key linkage area in the Gallatin Range focuses on the north end near the national forest boundary, where landscape patterns might funnel the natural flow of animals moving in a north-south manner. The remainder of the Gallatin Range would be under a variety of land designations and allocations that that would maintain habitat connectivity for wildlife movement. The Bridger Range is part of the Central Linkage Region identified by Inman and associates (2013) as of high importance for habitat connectivity and gene flow between the larger contiguous blocks of high quality wolverine habitat. The Bridger Range is identified as important connecting habitat for a wide range of wildlife, due to its close proximity to larger contiguous blocks of relatively undisturbed habitat. The upper elevations within the key linkage area maintain persistent spring snow. Year-round limits on management effects within the key linkage area under alternatives B, C, and D, would provide more protection for potential wolverine dispersal routes than would occur under either alternative A (current plans) or alternative E. Based on amounts and distribution of persistent snow cover, potential wolverine dispersal routes have also been identified through the Crazy Mountains and the Madison Range (Schwartz et al. 2009, McKelvey et al. 2011). These areas are not specifically identified as key linkage areas in any alternative. However, both areas have other land use restrictions associated with designated wilderness (Spanish Peaks unit of the Lee Metcalf in the Madison Mountain Range), inventoried roadless areas (Madison and Crazy Mountains), and primitive or semi-primitive nonmotorized winter recreation opportunity spectrum (Crazy Mountains) under all alternatives.

Consequences to Wolverine from Forest Plan Components Associated with Other Resource Programs or Management Activities

Effects from Terrestrial Vegetation Management

All revised plan alternatives include forestwide desired conditions that the amount and distribution of alpine habitats and forest cover types supports the natural diversity of seral stages, habitats and species composition across the landscape, allowing for appropriate recruitment and responses following disturbances. Conditions on the Custer Gallatin should support natural diversity and distribution of native plant species, generally within the natural range of variation to which wolverines have adapted over time. Collectively, plan direction for vegetation management under the revised plan alternatives would contribute to the restoration and maintenance of ecological integrity, including a level of biodiversity that supports the resilience and adaptive capacity of forest habitats to respond to a range of disturbance processes. In winter both female and male wolverines in the Greater Yellowstone Area select habitat with fir-associated conifer forest as well as forest and non-forest edges (Heinemeyer et al. 2017). On the Custer Gallatin, these conditions are represented by spruce and subalpine fir, mixed with lodgepole pine and Douglas fir. Predicted changes in climate indicate that some of these subalpine tree species, notably subalpine fir and lodgepole pine, could see shifts in suitable habitat to higher elevations over time. However, these species are currently within the natural range of variation, and would be maintained within that desired range under all alternatives over the life of the plan. While high elevation forest conditions would be maintained to a large degree under all alternatives, the revised plan alternatives provide substantially more detail as to desired conditions over time, with more emphasis on ecological structure and composition than direction contained in existing plans (see the terrestrial vegetation section of the draft environmental impact statement for more detail).

Objectives for vegetation management vary by alternative, with more emphasis on vegetation management for timber production purposes in alternative E, compared to a higher emphasis on vegetation management for purposes benefitting wildlife, at-risk species habitat, or general terrestrial ecosystem functions in alternatives D, B and C. Vegetation management for timber production purposes is not expected to directly affect wolverine habitat because so much of the primary habitat is in designated wilderness and other areas not suitable for timber production. However, accomplishing objectives for higher timber production elsewhere on the Custer Gallatin would reduce resources that might otherwise be available to achieve objectives for resources that might benefit wolverine habitat. Therefore, A, B and C, while alternative E objectives for vegetation management would be least favorable to wolverines.

Effects from Fire and Fuels Management

All revised plan alternatives contain desired conditions for wildland fires that burn within a range of intensity, severity and frequency that allows ecosystems to function in a resilient and sustainable manner, with corresponding vegetation conditions that support natural fire regimes. Guidelines under all revised plan alternatives for use of minimum impact fire suppression tactics to avoid resource damage, including negative impacts to habitat for at-risk species. Predicted climate trends call for warmer temperatures and less precipitation than historical conditions, likely resulting in larger fires over longer burning seasons (see fire and fuels section of the draft environmental impact statement). The revised plan alternatives incorporate complementary desired conditions for fire, fuels and vegetation management with an emphasis on forest conditions that are more resilient to predicted increases in disturbance patterns compared to direction in existing plans. Coordinated management of fire, fuels and vegetation to mitigate negative effects of changing climate could benefit wolverine habitat by managing to strategically maintain vegetation conditions for maximum snow retention. Under all revised plan alternatives, an exception for desired fire and fuel conditions within natural fire regime patterns is identified within the wildland urban interface and areas adjacent to infrastructure. These areas would be managed to maintain vegetation conditions to support only low-intensity fires. The revised plan alternatives include objectives for hazardous fuel mitigation in wild and urban interface areas as well as for ecological restoration and maintenance in other areas. Given the ecological niche occupied by wolverines at high elevations, in cold, rugged terrain with high levels of snow accumulation and persistence (Inman et al. 2011, USDI FWS 2013b), there is little overlap between wolverine primary range and wild and urban interface, so fire and fuels management focused in wild and urban interface areas would have little effect on wolverines.

Effects from Carbon Storage and Sequestration Management

The revised plan alternatives all contain a desired condition for carbon storage and sequestration sustained by biologically diverse and resilient vegetation conditions that are adapted to natural disturbance processes and changing climates, whereas the existing plans have no direction pertaining to carbon management. All revised plan alternatives contain plan components that explicitly provide for ecosystem resiliency, and acknowledge carbon storage as an important function of National Forest System lands. The revised plan alternatives incorporate affirmative measures to improve ecosystem resilience relative to predicted changing climates, which would promote more proactive mitigation for possible impacts to wolverine habitat compared to the current plans.

Effects from Land Allocations

Of the forest plan allocations, recommended wilderness areas have the highest level of restriction on management actions, leaving natural succession and disturbance processes as the primary change agents for wolverine habitat conditions over time. Restrictions on use of mechanized and motorized equipment in alternatives C and D would result in lower levels of disturbance due to noise and human presence. Alternative D has by far the highest amount of recommended wilderness area that overlaps primary and maternal wolverine habitat, followed by alternatives C, B and A. Alternative E has no recommended wilderness area in primary or maternal wolverine habitat. Much of the recommended wilderness area in the revised plan alternatives is already in wilderness study area or inventoried roadless area. Adding a recommended wilderness allocation in inventoried roadless areas would increase the number of land management restrictions for new structures, removal of saleable minerals, new recreation events, new recreational motorized and mechanized means of transport in alternative B and all recreational motorized and mechanized means of transport in alternatives C and D, which in turn would provide added security from human disturbance for wolverines. The major implication for wolverines would be that motorized over snow recreation would not be a suitable use in recommended wilderness area, except on about 4,500 acres in alternative B, whereas motorized oversnow use is currently allowed in some portions of inventoried roadless areas. Alternative D would result in the greatest reduction of motorized over snow use in maternal and residential wolverine habitat, followed by alternative C as compared to the existing condition. Motorized over snow opportunity in alternative B remains the same as alternative A.

Backcountry areas would be maintained as generally undeveloped or lightly developed, meaning they would typically have no roads, or few primitive roads. They may contain no trails, nonmotorized use trails only, or a combination of motorized and nonmotorized use trails, depending on the geographic area in which they occur. As with recommended wilderness, backcountry areas often spatially overlap with inventory roadless areas, limiting certain types of use. With an emphasis on low development, the backcountry areas would have lower disturbance from noise and human disturbance than non-designated areas, through restrictions on new energy or utility corridors, communication sites, salable mineral removal, and new developed recreation sites. However, land uses are less restricted in backcountry areas than in recommended wilderness areas. Backcountry areas are generally small relative to wolverine habitat in all alternatives, except for alternative E, which would allocate the entire Hyalite Porcupine Buffalo Horn Wilderness Study Area (over 140,000 acres) as a backcountry area, whereas the Hyalite Porcupine Buffalo Horn would be entirely allocated recommended wilderness area in alternative D, and combinations of recommended wilderness area, backcountry area and other allocations in alternatives B and C. Motorized over snow opportunity would increase in the Buffalo Horn backcountry area in alterative E. In other backcountry areas, and in the Buffalo Horn backcountry area in other alternatives, motorized over snow opportunity would not change from existing conditions within the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas.

Recreation emphasis areas are forest plan allocations that vary by alternative. All potential recreation emphasis areas are located in the montane geographic areas that contain wolverine habitat. Recreation emphasis areas currently have, and are expected to continue to receive, relatively high levels of motorized and nonmotorized recreation use, and may have a high density of recreation-related infrastructure relative to other parts of the Custer Gallatin. Recreation emphasis areas are small relative to the scale at which wolverines use the landscape. The revised plan alternatives have identified three winter recreation emphasis areas. The Cooke City winter recreation emphasis area (alternatives B, C and E) is roughly 24,000 acres, and includes both maternal and primary wolverine habitat. Hebgen winter recreation emphasis area (alternatives B, C and E) is roughly 72,000 acres, with a small amount of primary habitat, and very little maternal habitat, most of the Hebgen recreation emphasis area is suitable for female and male wolverine dispersal. The Bridger winter recreation emphasis area (alternative E) is roughly 5,300 acres. This recreation emphasis area is mostly dispersal habitat, but has some primary habitat, and very little maternal habitat for wolverines. These areas are all close to population centers or areas that are currently managed, and heavily used for winter recreation. None of these recreation emphasis area allocations would occur under alternative D. However, no other allocations are proposed for these areas under alternative D, which means none of the existing features that attract high levels of winter use to these areas would be removed or otherwise altered, and management would continue to focus on recreation opportunities in these areas under alternative D. Therefore, regardless of whether these areas receive forest plan allocation for winter recreation emphasis, winter use would likely remain at high levels under all alternatives. The Hebgen winter recreation emphasis area is part of the area in which winter recreation effects on wolverines has been studied. Heinemeyer and associates (2017) recorded high levels of motorized winter use in this area, but also showed both a female and male wolverine home range overlapped with the recreation emphasis area, indicating some level of tolerance for recreation use.

In addition to the recreation emphasis areas that are specifically allocated for winter use, a number of recreation emphasis areas are allocated for year-round recreation, which could include motorized and nonmotorized winter recreation. Recreation emphasis areas tend to have better access with paved and or plowed roads than other parts of the national forest, which may serve to consolidate winter recreation use, thereby reducing potential impacts to wolverines in more remote locations. Most of the year-round recreation emphasis areas are in lower elevation areas, and therefore mainly impact wolverine dispersal habitat. The few year-round recreation emphasis areas that overlap slightly with primary and maternal habitat are within semi-primitive nonmotorized winter recreation opportunity class under all alternatives, so would only receive nonmotorized winter recreation. All revised plan alternatives include a guideline to manage and rehabilitate administrative infrastructure, such as temporary roads, skid trails and landings to reduce the likelihood of establishing unplanned visitor use patterns, which would limit the amount of new potential winter access routes into wolverine habitat.

Effects from Infrastructure, Roads, Trails, and Aircraft Landing Strip Management

Wolverine distribution is associated with remote locations, which has at times been correlated with avoidance of humans and human infrastructure. However, historic records of wolverines in the continental United States have all been associated with high elevation, alpine, subalpine, or relatively cold climatic conditions. Given the similarity between known historic and current distribution of wolverines, it is possible that the ecological niche occupied by wolverines, including high elevation, cold, rugged terrain with substantial snow accumulation and persistence, naturally isolates them from the human developments typically located in more hospitable environs (Inman et al. 2011, USDI FWS 2013b).

All alternatives allow for potential construction and use of non-commercial recreational aircraft landing and take-off strips in certain areas. Current forest plans are silent on aircraft landing strips, although aircraft landing strips are addressed in the Gallatin Travel Plan. No such facilities currently exist. Alternative A has the largest acreage where aircraft landing strips could potentially be constructed within or near wolverine habitat, while alternative D would have no areas suitable for aircraft landing strips. Alternatives B, C and E have limited acreage suitable for aircraft landing strips. The majority of maternal and primary habitat for wolverines is in areas that are not suitable for aircraft landing strips. Therefore, any new aircraft landing strips conducted under any alternative would typically be in wolverine dispersal habitat, which would have few notable impacts on wolverines. Finally, all aircraft landing strips would be authorized under a special use permit, and a wolverine guideline under all revised plan alternatives would preclude any such permits for winter use in maternal habitat.

Some research has indicated a negative relationship between roads and wolverine occurrence (Carroll et al. 2001, Rowland et al. 2003). While there may be a correlation, it could be due to the fact that the remote, rugged terrain selected by wolverines is not conducive to road development. Wolverines have been shown to avoid major transportation routes (such as paved roads with high volume, high speed vehicle traffic) in their daily movements. However, dispersing wolverines have been known to successfully cross major transportation routes, but there have also been documented wolverine mortalities due to vehicle collision along major routes. Major routes (paved highways) bisect the Custer Gallatin National Forest in a number of places, but only one, US Highway 212, is located at elevations most commonly known to be used by wolverines. Most roads in high quality wolverine habitat are low-speed, low traffic volume, dirt or gravel roads, that are not likely to cause wolverine avoidance (USDI FWS 2013b). However, it should be noted that Scrafford and associates (2018) recently documented wolverine avoidance of low traffic roads in Alberta, Canada, suggesting that wolverines may be wary of other predators travelling low-use roads. There have been no known mortalities of wolverines caused by vehicle collisions on Custer Gallatin Forest System roads.

Under all revised plan alternatives, forestwide plan components include desired conditions to provide a safe, efficient transportation system for public and administrative use, with minimal impacts on other resources, including at-risk species. In order to minimize impacts, the revised plan alternatives include plan components that encourage use of technologies that reduce impacts to other resources, and facilitate removal and restoration of roads and facilities no longer needed. The forestwide plan components for infrastructure do not vary by alternative, therefore, effects to wolverine would be the same under all revised plan alternatives. However, all revised plan alternative components provide more detailed guidance, and more restrictions on construction of new roads and other facilities, than currently contained in existing plans, so the revised plan alternatives would provide slightly higher protection for wolverine habitat.

Inman and others (2011) identified increasing human infrastructure and rural sprawl as potential stressors on wolverine habitat connectivity. However, the U. S. Fish and Wildlife Service concluded that current best science does not show that wolverines avoid human developments, nor is there any empirical evidence that wolverine dispersal is negatively affected by human infrastructure (USDI FWS 2013b). Aside from the few roads and trails, there is little human infrastructure in primary wolverine habitat, and what is there is generally primitive, often low use sites such as administrative facilities and rental cabins. Some limited infrastructure associated with developed ski areas occurs on National Forest System lands. Administrative sites at lower elevations include ranger stations, visitor centers, and work centers, which may contribute to human development impacts on wolverine dispersal. All revised plan alternatives contain plan components to protect water quality and quantity, and protect other natural resources through proper location, design, and maintenance of administrative and recreation developed sites.

Effects from Recreation Management

Effects from recreation were largely described above under effects common to all alternatives. All revised plan alternatives include myriad components for recreation, including numerous desired condition statements and accompanying standards and guidelines for managing recreation facilities, permits, and uses in a manner that is consistent with wildlife habitat sections of the plan, at least in part because wildlife viewing, photography, hunting, and trapping are important to recreationists visiting the Custer Gallatin National Forest. As noted in the affected environment, the amount of designated areas, such as wilderness, wilderness study, and inventoried roadless areas, remain the same across all alternatives. The main differences between alternatives regarding how recreation management might affect wolverines is due to forest plan allocations, which vary by alternative, and are discussed below.

Many of the predicted effects of climate change on snow amount, distribution and persistence, along with associated impacts on wolverines are uncertain (USDI FWS 2014b). However, there is strong evidence that snowpack is already declining in many parts of the wolverines range. At this time, the human population is growing rapidly in areas near the montane ecosystem that supports wolverines on the Custer Gallatin, with associated increased demand for winter recreation opportunity. The predicted decline in snowpack over the western United States (McKelvey et al. 2011) combined with ongoing human population growth could result in increased overlap between winter recreation use and wolverine distribution, as both humans and wolverines respond to continued decline in snow cover (Heinemeyer et al. 2017). So, while parts of the Custer Gallatin forest are predicted to retain persistent snow better than other parts of the country, these areas could see increased use by winter recreation enthusiasts, which could have increased disturbance impacts on wolverines.

Cumulative Effects

Adjacent forest plans contain some direction for managing wolverine habitat, most of which is focused on maintaining habitat connectivity and minimizing disturbance near reproductive den sites. The Beaverhead-Deerlodge plan (2009) contains an objective to maintain habitat integrity for wolverines. The Helena Lewis and Clark (Draft) plan (2018) contains desired conditions for various geographic areas to provide habitat connectivity for wide-ranging species including the wolverine. The Targhee plan (1997) includes an objective to survey for wolverine den sites and document their presence, and a monitoring item to track wolverine population trends. The Shoshone plan (2015) includes goals to conserve wolverines and maintain habitat connectivity. It states desired conditions for sensitive species (including wolverines) to have self-sustaining populations and habitat into which they can expand, as well as a standard for sensitive species (including wolverines) that management actions near denning sites be designed to avoid disrupting reproductive success. Wolverines are classified as a furbearer in Montana, although the trapping season for wolverine is effectively closed, with a quota of zero and no harvest allowed. If a wolverine is accidentally caught in a trap set for other furbearer species, the trapper must notify Montana Fish Wildlife and Parks within 24 hours and inform appropriate personnel if the wolverine cannot be released from the trap uninjured. It is unlawful for any person to possess the pelt of a furbearer that is taken unintentionally (Montana FWP 2018a). These management plans are compatible with Custer Gallatin proposed direction under all revised plan alternatives, and collectively would function to conserve wolverines.

Conclusion

Warming climates and impacts on persistent snow cover are the primary threats to wolverines. Forest management actions under all alternatives are unlikely to have a notable impact on climate or associated persistence of spring snow cover in primary wolverine habitat on the Custer Gallatin National Forest. Other than a strong reliance on snow cover, wolverines are habitat generalists with no strong dependence on particular vegetation composition, structure, or other habitat features. Forest land management actions occur on a small scale relative to the size of a wolverine's home range, and the US Fish and Wildlife Service found few negative effects to wolverines directly associated with land management actions such as timber harvest, livestock grazing, or mining (USDI FWS 2014b). Therefore, the primary mechanism by which human use of National Forest System lands might affect wolverine persistence on the Custer Gallatin is through disturbance effects in winter, particularly those that may disrupt reproductive success of female wolverines. The revised plan alternatives include plan components designed to increase vegetation resilience to climatic stressors, which may help mitigate negative impacts from climate change, as well as a suite of plan components and land use allocations that would limit disturbance effects on wintering wolverines. Finally, the revised plan alternatives contain desired conditions for habitat connectivity, including specific plan components to limit management impacts in key linkage areas in alternatives B, C and D. Collectively, the revised plan alternatives are more proactive and specific for managing to conserve wolverines, as well as providing for ecological integrity in the face of climate change, making the revised plan alternatives more favorable for wolverines than the current plans. In summary, all alternatives would provide ecological conditions that would contribute to the long-term persistence of wolverines, through maintenance of protections that limit human disturbance in maternal and primary habitats.

3.10.3 Wildlife Species of Conservation Concern

Species of conservation concern are those "species other than federally recognized threatened, endangered, proposed, or candidate species, that are known to occur in the plan area and for which the Regional Forester has determined that the best available scientific information indicates substantial concern about the species' capability to persist over the long term in the plan area" (36 CFR 219.9 (c)). The existing forest plans operate under a policy for sensitive species, which are "those plant and animal species identified by a Regional Forester for which population viability is of concern: (FSM 2670.22). Both categories were established in order to maintain persistent populations of species on National Forest System lands. The 2012 rule notes that Regional Forester sensitive species are similar to species of conservation concern, but concludes that the shift to species of conservation concern is more focused than the emphasis on sensitive species under the viability provisions of the 1982 rule. Sensitive species include all vertebrate species for which population viability is a concern, regardless of whether there is substantial concern for persistence of the species in the plan area. Species of conservation concern include invertebrate species as well. Species of conservation concern must be native to, and known to occur in, the plan area, whereas sensitive species could include non-native species, or species whose presence in the plan area is only suspected due to habitat capability. Under the current plans, the Custer Gallatin would continue to operate under existing policy for Regional Forester sensitive species (FSM 2670.22), whereas if any of the other alternatives (B through E) are selected, Custer Gallatin would shift to policy prescribed for species of conservation concern. The revised Forest Service Manual policy regarding species of conservation concern is forthcoming and specific changes and impacts to species are unknown. However, the 2012 Planning Rule states that if plan components to maintain ecosystem integrity and diversity are insufficient to provide ecological conditions to maintain long-term persistence of each species of conservation concern within the plan area, then additional species-specific plan components are to be included to provide such ecological conditions (36 CFR 219.9 (2)(b)).

As mentioned above, unless and until a new forest plan is approved (under the current plans), the Custer Gallatin National Forest will continue to operate under the Forest Service policy for Regional Forester sensitive species. The Regional Forester's list of sensitive species may change over time. The current list of sensitive species known or suspected to occur on the Custer Gallatin National Forest can be found on the USDA Forest Service Northern Region website www.fs.usda.gov/detail/r1/plants-animals. If a new plan is approved (for example under alternatives B through E), the Custer Gallatin would follow policy for species of conservation concern. At the date of this analysis, the Regional Forester had identified two terrestrial wildlife species of conservation concern for the Custer Gallatin National Forest. The Regional Forester's list of species of conservation concern is dynamic and may be updated based on new information or changing conditions. The current list of species of conservation concern, along with the criteria and rationale for their selection, can be found on the Regional website at: www.fs.usda.gov/goto/R1/SCC.

Greater Sage-Grouse (*Centrocercus urophasianus*)

The greater sage-grouse is on the Regional Forester's list of species of conservation concern for the Custer Gallatin National Forest. The greater sage-grouse, hereafter referred as sage-grouse, is North America's largest grouse, and is a sagebrush-steppe obligate species dependent upon the sagebrush for nearly all components of its lifecycle. Sage-grouse are not migratory, remaining year-round within the sagebrush-steppe ecosystem. Within an individual's home range there is variability in seasonal habitat needs and movement patterns. For example, hens in northwestern South Dakota moved up to 25 miles in late summer, eventually returning to nesting grounds (Kaczor 2008). Leks, or breeding grounds, are typified by more open ground with sparse vegetation relative to the surrounding area. Male sage-grouse are known for their flamboyant displays at leks during the breeding season. Lek locations are often driven by the proximity of suitable nesting habitat. Sage-grouse are a ground nesting species typically nesting under sagebrush. Other nesting habitat criteria includes a suitable amount and height of desirable grass and forb species, which provide hiding cover and forage. Brood-rearing habitat can be divided into two key periods, early and late. Early brood-rearing occurs post hatch within the surrounding sagebrush dominated uplands. As the uplands begin to dry out broods relocate to wet meadows, agricultural lands adjacent to sagebrush, and higher elevation sagebrush-steppe, where forage is primarily comprised of succulent forbs and invertebrates such as grasshoppers, beetles and ants. Sage-grouse winter exclusively in sagebrush communities, typically selecting flat areas with dense sagebrush cover that protrudes above the snow. During winter, sagebrush represents the primary food source and provides cover from harsh conditions. They have also been found wintering in wind-swept areas where sagebrush plants are exposed throughout the winter months (Marks et al. 2016).

Sage-grouse was petitioned for listing under the Endangered Species Act in 2010, at which time the U.S. Fish and Wildlife Service determined it to be "warranted but precluded" from listing. The primary drivers for the warranted determination were loss and fragmentation of habitat and the lack of regulatory mechanisms to address habitat loss. Rangewide, sage-grouse currently occupy about 56 percent of their historic range (USDI FWS 2015c). In 2015, after a review of the best available scientific and commercial information, the U.S. Fish and Wildlife Service determined that the greater sage-grouse did not warrant listing protections under the Endangered Species Act because the primary threats to populations had been ameliorated by conservation efforts implemented by Federal, State, and private land owners (Ibid). The sage-grouse is identified as a species of greatest conservation need in state wildlife action plans for Montana and South Dakota (Montana FWP 2015a, South Dakota GFP 2014).

Sage-grouse habitat within the planning area is categorized as either priority habitat (core areas) or general habitat. There are approximately 2,200 acres of priority habitat within the planning area found on the lower elevation fringes of the Sioux Geographic Area. Priority habitat was designated because it likely contains approximately 75 percent of all known breeding sage-grouse and represents landscapes of greatest biological importance to the long-term persistence of the species. Given the importance of the number of displaying males in deriving population estimates, priority habitat includes those areas surrounding locations with the largest number of displaying males on leks. Approximately 123,400 acres of the Custer Gallatin is identified as general habitat. General habitat provides habitat for sage-grouse, but is not considered priority. On the Custer Gallatin, general sage-grouse habitat is characterized by mountain big sagebrush in the montane ecosystem and Wyoming big sagebrush in the pine savanna ecosystem (USDI FWS 2013c); however silver sagebrush is also found in sage-grouse habitat in the South Dakota portion of the pine savanna ecosystem (South Dakota GFP 2014).

Analysis Area

On the Custer Gallatin National Forest, sage-grouse habitat is found in the Pryor Mountains, Ashland, and Sioux Geographic Areas. These areas combined with adjacent lands containing occupied sage-grouse leks, were used as the analysis area.

Affected Environment (Existing Conditions)

Sage-grouse are known to occur within the Custer Gallatin National Forest, with the vast majority of general and priority sage-grouse habitat located in three geographic areas. These geographic areas are split across two different management zones, as identified in a collaborative effort through the Wester Association of Fish and Wildlife Agencies. Sage-grouse management zones were identified by floristic provinces, and sage-grouse populations (Stiver et al. 2006). These management zones facilitate conservation efforts across expansive landscapes, including multiple states and management jurisdictions. The Ashland and Sioux Geographic Areas are located in the Great Plains Management Zone, and the Pryor Mountains Geographic Area is in the Wyoming Basin Management Zone. Collectively, the U.S. Forest Service represents only 2 percent of the land ownership in each of these zones, and the Custer Gallatin accounts for a very small proportion of the National Forest System lands represented in each management zone. Perhaps because it is such a minor habitat component on the Custer Gallatin, occupied sage-grouse range has decreased only slightly across the Custer Gallatin over time relative to historic levels.

There are currently no confirmed active leks on the Custer Gallatin. There is documentation of three historic leks at least partially located on the Ashland Geographic Area. These historic leks have been surveyed sporadically in recent years, with no sage-grouse detected. Due to sporadic surveys, the status of these three leks remains unconfirmed but inactive. Within the national forest boundary there is a total of 2,204 acres of priority habitat divided between the Ashland (336 acres) and Sioux (1,868 acres) Geographic Areas. This priority habitat is associated with sage-grouse leks located on adjacent lands outside the national forest boundary (DeVore, R. Montana FWP. 2018. pers. comm., South Dakota GFP 2016). Priority habitat is distributed on the periphery of Custer Gallatin managed land, making up only about 1 percent of the Sioux Geographic Area, and less than 1/10th of 1 percent of the Ashland Geographic Area. Establishment of new sage-grouse leks either within or adjacent to the national forest boundary could result in a potential increase in priority habitat on the Custer Gallatin. Any potential increase would be limited by the relatively small amount of suitable habitat available on the Custer Gallatin.

The vast majority of sage-grouse general habitat on the Custer Gallatin National Forest is found on the Pryor Mountains, Ashland, and Sioux Geographic Areas. This habitat typically occurs outside of timbered areas in lower elevation sagebrush dominated habitats. Roughly 35 percent of the Pryor Mountains Geographic Area is identified as general habitat (27,392 acres), and has had the most recent and highest numbers of sage-grouse observations on the Custer Gallatin. Observations have been restricted to hens and chicks utilizing the high meadows during the late brood-rearing season. Nest sites for these broods were located outside the national forest boundary, (Pratt and Dillon 2015). Ashland Geographic Area has the most acres of general sage-grouse habitat 101,290 acres, accounting for approximately 20 percent of the geographic area. The Sioux Geographic Area contains 8,424 acres of general habitat, which represents roughly 5 percent of the geographic area. All other geographic areas, including Absaroka-Beartooth Mountains, Bridger, Bangtail, and Crazy Mountains, Madison, Henrys Lake, and Gallatin Mountains have only minute amounts of sage-grouse habitat, each well below 1 percent of the geographic area size. Figure 37 and figure 38 show distribution of priority and general sage-grouse habitat.

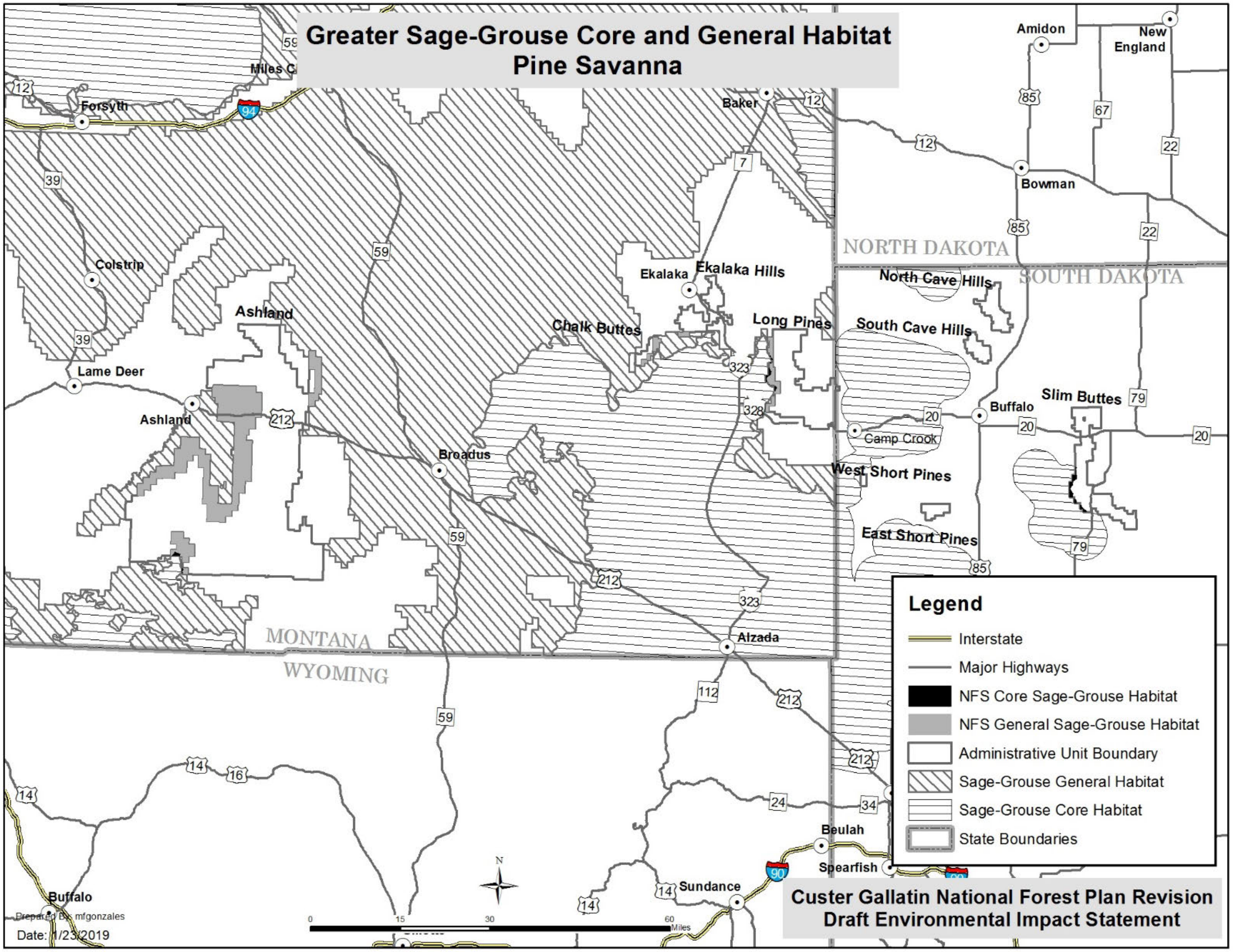

Figure 37. Distribution of priority and general sage-grouse habitat, pine savanna ecosystem

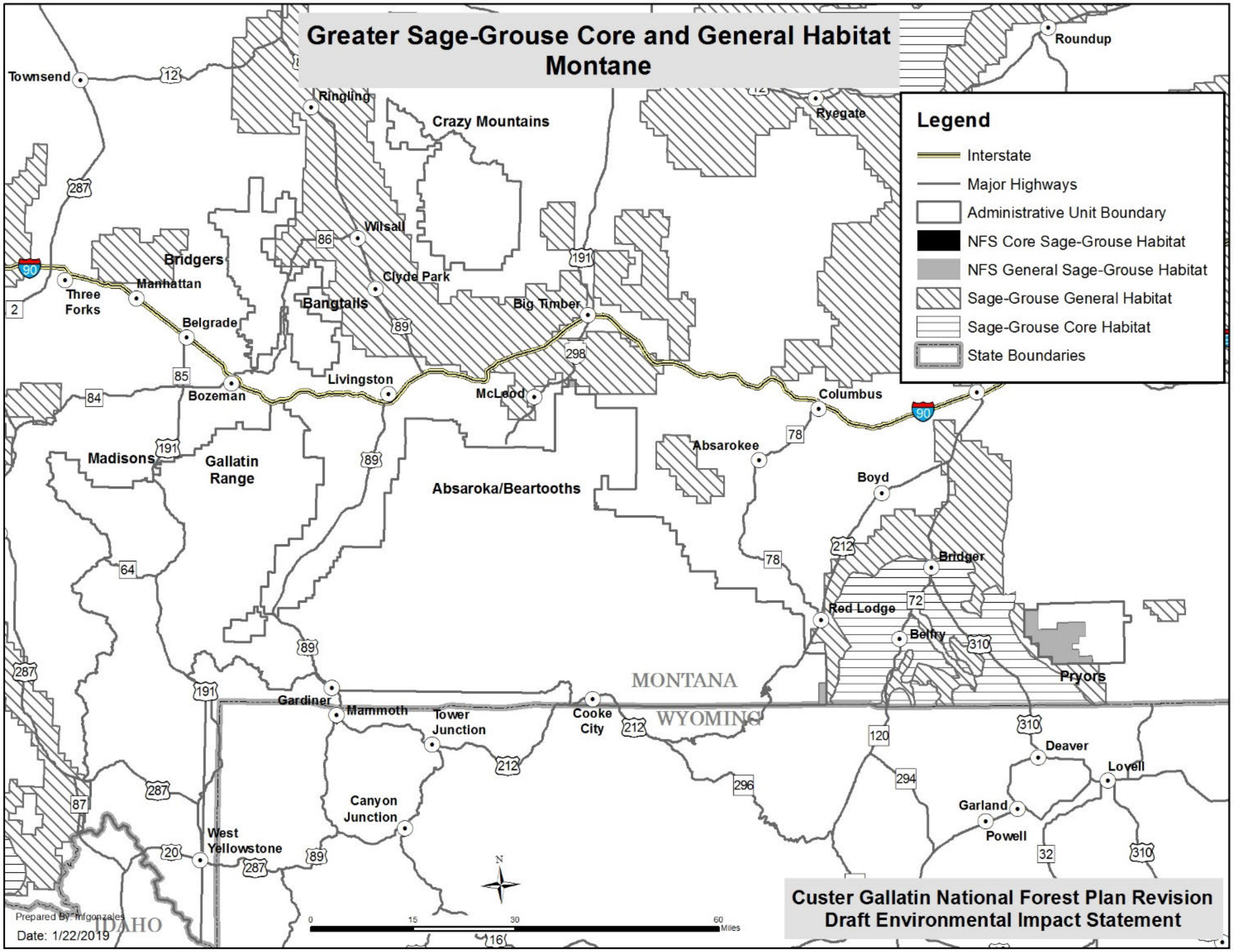

Figure 38. Distribution of priority and general sage-grouse habitat, montane ecosystem

Key Stressors

The U. S. Fish and Wildlife Service cited habitat loss and fragmentation as primary causes for greater sage-grouse population declines and some areas of local extirpations in recent decades. Habitat impacts are caused by a variety of factors, but energy development, agricultural conversion, conifer encroachment, and wildfire and invasive species were listed by the U. S. Fish and Wildlife Service as primary concerns (USDI FWS 2015c). Human land use can affect sage-grouse by physically altering habitat, which can result in permanent loss due to sagebrush conversion for agricultural, residential, or commercial purposes. Human use can also cause functional loss of habitat due to disturbance from noise and human presence (USDI FWS 2013c).

Fire, both natural and human caused, is a major factor associated with loss of sagebrush habitats and corresponding population declines for sage-grouse. Fire frequency and associated habitat loss has increased in the western portion of sage-grouse range in recent years, at least partly facilitated by the presence and spread of non-native grasses such as cheatgrass, Japanese brome, and timothy. Other invasive plants may also impact sage-grouse habitat. Climate change has the potential to influence the spread and distribution of non-native plants over time, as well as to increase the frequency and severity of fires. Conifer encroachment can result from changes in fire return intervals, which can in turn be influenced by fire suppression activities. Increased conifer presence may also be caused by overgrazing of domestic livestock. Climate change may facilitate conifer encroachment through increased carbon dioxide concentrations, but this theory has not been proven conclusively. Traditionally, fire and other vegetation management practices have been used to remove sagebrush in order to enhance grazing conditions for domestic livestock. Grazing pressure from livestock, as well as impacts from wild ungulates and free-roaming horses have all been identified as potential stressors for sage-grouse and their habitats (USDI FWS 2013c). All of the priority habitat, and most of the general sage-grouse habitat on the Custer Gallatin are within livestock grazing allotments. Wild (feral) horses are present in the Pryor Mountains Geographic Area, but their range does not overlap with sage-grouse habitat. Wild ungulates, primarily deer, but also pronghorn antelope and increasing numbers of elk, are present within portions of the Custer Gallatin that contain sage-grouse habitat.

Other factors that can affect sage-grouse populations include disease, parasites, predation, and weather events such as sever spring storms or periods of drought. These types of threats can vary in spatial and temporal impacts, but may impact populations locally. For example, in 2008, West Nile virus impacted the sage-grouse population in southwest North Dakota (USDI FWS 2013c). This event occurred in close proximity to the easternmost part of the Sioux Geographic Area, where both primary and general sage-grouse habitat are located.

Environmental Consequences

Management Direction under the Current Plans

Only the Custer Plan contains management direction for this species. The Custer Plan establishes spatial and temporal restrictions on disturbance actions relative to lek locations and sets a stubble height requirement within 1 mile of lek locations. The Custer Plan does not identify greater sage-grouse as a management indicator species. Sagebrush control activities are permitted to occur outside of designated big game and sage-grouse winter ranges.

Effects of the Current Plans

The spatial and temporal restrictions set forth in the Custer Forest Plan are designed to reduce impacts to breeding and nesting grouse in the immediate vicinity of a lek. Some of the established disturbance offset distances may not be adequate, this includes the 0.25 mile restriction on ground disturbing activity between March 1 and April 15. Knick and Hanser (Connelly et al. 2011) identified a negative influence on lek persistence associated with the level of human footprint within 5-km (3 mi) of the lek. U.S. Geologic Survey published a set of potential conservation buffer distances based on the category of disturbance type. The conservation buffer for surface disturbing activities ranged from 5 to 8-km (3 to 5 mi) (USGS 2014). Under the existing Custer Forest Plan the protection of suitable habitat away from known lek locations is limited. The allowance for sagebrush control within sage-grouse winter range would enable the potential removal of suitable nesting and brood rearing habitat if located outside winter range. Holloran and Anderson (2005), found 64 percent of nests occurred within 5-km from a lek within relatively contiguous sagebrush habitat. This suggests nesting hens could be impacted by actions within suitable habitat several miles from the breeding location. In addition, the Custer and Gallatin plans do not incorporate recent general and priority habitat designations established by the states of Montana and South Dakota respective conservation plans. These habitats would not receive any additional protections or consideration under this alternative.

Management Direction under the Revised Plan Alternatives

Forestwide plan components with the potential to affect sage-grouse would be the same under all revised plan alternatives. These alternatives incorporate some existing direction, as well as new plan components. Alternatives B through E include a desired condition that sage-grouse habitat contains contiguous areas of native vegetation, including a variety of sagebrush-community compositions, little or no invasive species present, and variation in species composition, shrub cover, herbaceous cover and stand structure, to meet seasonal requirements for food, cover, and nesting (FW-DC-WLSG). Plan components include a standard that requires vegetation management Greater sage-grouse priority and general habitat, to result in no net loss of habitat or be beneficial to sage-grouse (FW-STD-WLSG). Additional guidelines address tactics and strategies to minimize the loss of existing habitat through fire management tactics, use of appropriate seed mixes in rehabilitation, infrastructure development restriction for transmission corridors and recreation facilities, control of non-native grasses and conifer encroachment, design of range management structures, and the location of energy development (FW-GDL-WLSG).

Effects of the Revised Plan Alternatives

Under the revised plan alternatives, the greater sage-grouse would no longer be managed as a Forest Service sensitive species. Compared with the current plans, the revised plan alternatives, B through E, would provide greater protection for sage-grouse and seasonal habitats. These alternatives incorporate the priority and general habitat designations within Montana and South Dakota. Individual vegetation projects within designated general and priority habitats shall be designed to result in no net loss of habitat or provide a benefit to the species. Relative to the current plans, the standards and guidelines set forth in these alternatives would provide protection across all seasonal habitats and address the key stressors to sage-grouse previously discussed. The plan components would reduce the probability of non-native or undesirable species introduction through wildfire rehabilitation and vegetation management projects. In addition, man-made facilities and structures would be located and designed so as to be a conservation gain or have neutral impacts. An example of a conservation gain would be relocating a facility out of priority habitat into general or non-habitat, or consolidation of multiple dispersed facilities affecting priority or general habitat into fewer developed sites with a smaller footprint, affecting less priority and general habitat.

Consequences to Greater Sage-grouse from Forest Plan Components Associated with Other Resource Programs or Management Activities

Effects from Watershed, Riparian and Aquatic Management

Revised plan alternatives forestwide plan components associated with watershed, aquatic and riparian ecosystems, as well as those associated with terrestrial vegetation set the coarse filter strategies that have the potential to help maintain or restore sage-grouse habitat. The revised plan alternatives provide more detailed guidance than the current plans for protection of watersheds, riparian areas and aquatic habitats. The revised plan alternatives include the adoption of riparian management zones, which are greater in size from the riparian zones currently identified for streams east of the Continental Divide. Specifically, the riparian management zone direction restricts management activities with few exceptions, to allow only those intended to restore, maintain or improve aquatic and riparian habitats. These components would protect or improve habitat conditions in areas representative of sage-grouse late summer brood-rearing seasonal habitats.

Effects from Terrestrial Vegetation Management

The management of grassland, shrubland, woodland, and riparian vegetation could affect the condition of sage-grouse habitats in beneficial, neutral, or harmful ways. As discussed previously sage-grouse seasonal habitats extend across a variety of landscapes and ecosystems and therefore require a diversity of vegetation types to meet their seasonal habitat needs. Plan components under revised plan alternatives may provide for this diversity through the targeted development or maintenance of resilient communities that are comprised of diverse native plant assemblages with limited encroachment by conifers.

Effects from Land Allocations for Recommended Wilderness and Backcountry Areas

Aside from forestwide plan components, the alternatives differ in their proportion of backcountry area and recommended wilderness area designations. The backcountry area designation is designed to allow for natural processes with little evidence of long-lasting human use. The recommended wilderness area designation allows natural processes such as wildfire, disease, or natural succession to be the primary forces that shape the environment. These land use designations come with a series of land use restrictions that prohibit certain types of human use. In the case of backcountry areas prohibitions include the construction of new roads, new recreation facilities, new utility corridors, commercial communication sites, and removal of new saleable mineral material. All special uses must be compatible with backcountry character. Recommended wilderness areas are more restrictive in land use allowance than backcountry areas in prohibiting any new recreation developments, recreation events, new recreational motorized, and mechanized means of transport in alternative B and all recreational motorized and mechanized means of transport in alternatives C and D. The restrictions on development and types of human use associated with backcountry areas and recommended wilderness areas may result in the protection and retention of sage-grouse habitat. The prohibition of these activities could have the beneficial effect of the prevention of habitat degradation associated with physical disturbances and increased anthropogenic noise. In addition, prevention of the installation of tall structures associated with energy corridors or communication sites will not increase predator perch opportunities on the landscape.

Within the Ashland Geographic Area alternatives B and C designate the same three backcountry areas two of which contain sage-grouse general habitat. Under Alternative D the proposed backcountry areas would be recommended wilderness areas. The acreage of general habitat protected under Alternative D would be slightly lower than B and C given the exclusion of existing road corridors from the recommended wilderness areas. Alternative E proposes fewer land use restrictions than the current plans in the Ashland Geographic Area, because the current plans low development areas are very similar to the backcountry areas.

Under alternative D the Chalk Buttes unit in the Sioux Geographic Area would be managed as a backcountry area. The eastern side of the Chalk Buttes is within general habitat and would therefore receive the land use restriction protections described above. There are no other proposed land use designations within the remaining alternatives for the Sioux Geographic Area.

Within the Pryor Mountains Geographic Area land use restrictions are associated with alternatives B, C, and D. Alternatives B and C propose three backcountry areas. The proposed recommended wilderness area in alternative D would encompass more general habitat than backcountry areas proposed in alternatives B and C.

The remaining forest geographic areas contain a minute amount of general habitat. Only the proposed recommended wilderness area designations in alternative D overlap with portions of these small parcels of general habitat.

Effects from Permitted Livestock Grazing

Much of the designated sage-grouse habitat on the Custer Gallatin is located within permitted livestock grazing allotments. Utilization by livestock has the potential for impacts across all seasonal habitats. Grazing can influence sagebrush communities through reduced productivity, changing plant composition, and herbaceous structure. Indirect effects include those associated with grazing infrastructure, including mortalities associated with water troughs and fence strikes (Boyd et al. 2014). The revised plan alternatives contain a desired condition that grazing allotments supply livestock forage and contribute to local ranching operations, while staying within or moving toward desired ecological conditions. A standard would require new or revised allotment management plans to design grazing practices to maintain or improve resiliency of riparian and upland ecosystems. Grazing-specific guidelines contain measures to maintain or improve riparian habitat, including specific, quantifiable forage utilization measures within riparian areas. Infrastructure such as fences and water developments should be designed and located to prevent barriers to wildlife and provide for escape.

Effects from Minerals Management

Energy development has the potential to greatly impact sage-grouse populations and habitat through the removal and fragmentation of habitat and anthropogenic noise disturbances (Holloran et al. 2005). It is recommended that new energy development be located outside of sage-grouse priority habitat, subject to valid and existing rights. In addition, under all revised plan alternatives, mineral and energy development activities include provisions to reclaim disturbed areas and minimize adverse effects to riparian resources. Plan components also include requirements for infrastructure such as roads, trails and other facilities to minimize impacts to riparian habitats and limit disturbance to associated wildlife species. Components address potential impacts from the location of facilities and the introduction of invasive species through ground disturbing activities.

Effects from Recreation Management

The installation, maintenance and use of recreation facilities including trails has the potential to affect sage-grouse through removal or fragmentation of habitat and displacement through avoidance of human use. Within the revised plan there are several forest wide components that address the addition of new, and maintenance of existing, recreation facilities such as trails, campgrounds, picnic areas, etc. There is an objective to remove or relocate some existing recreation facilities out of riparian areas. The revised plan alternatives include desired conditions for recreation facilities to have minimal impacts on ecological integrity and diversity, as well as overall compatibility with natural resources. New developed sites would be designed to replace existing dispersed sites that are degrading riparian resources.

Cumulative Effects

In Montana and South Dakota, much of the existing sage-grouse habitat is located on non-federal land. In many cases, the habitat is distributed across a patchwork of ownership including private, State and Federal. Bureau of Land Management lands host the greatest amount of sage-grouse habitat in federal ownership. Bureau of Land Management Resource Management Plans for areas adjacent to the Custer Gallatin include extensive direction for sage-grouse habitat management. The Bureau of Land Management plan for the Billings Field Office covers lands adjacent to the Pryor Mountains Geographic Area, while the Miles City Field Office and South Dakota Field Office plans cover Bureau of Land Management lands adjacent to the Ashland and Sioux Geographic Areas. Sage-grouse priority and general habitat on the Custer Gallatin often occurs as an extension of sage-grouse habitat on adjacent lands. The states of Montana and South Dakota also have conservation strategies and management plans for greater sage-grouse. These plans all contribute to coordinated efforts to implement land management programs designed to conserve sage-grouse habitat. The U. S. Fish and Wildlife Service determined that the greater sage-grouse is not warranted for listing as a threatened or endangered species, partly due to the development of federal and state management plans that incorporate conservation principles to reduce the major threats to the species (USDI FWS 2015c).

Conclusion

The amount of high quality sage-grouse habitat is limited on the Custer Gallatin, with most mapped habitat occurring on the edges of what would be considered suitable habitat. There are currently no active leks on the Custer Gallatin. All of the revised plan alternatives contain plan components that are designed to protect or maintain sage-grouse populations and their habitat. Greater level of protections and more specific language is contained within the revised plan alternatives (B through E). These alternatives better address emerging issues and more thoroughly address issues and provide protections for all seasonal habitat needs compared to the existing plans (alternative A). Forest wide plan components address the known causes of population declines and habitat loss including fragmentation, development, conversion, encroachment, fire, and invasive species. Across each alternative, the allocation of land use restrictions differs within each of the geographic areas. The greatest level of benefit from these land use restrictions is associated with alternatives B, C, and D. Given the limited amount of potentially suitable habitat, the difference in protections provided by the land use allocations between alternatives B, C, and D is relatively small. The measures for managing permitted livestock grazing, vegetation management, mineral and energy development, as well as administrative and recreational facilities, could help protect, maintain, or restore seasonal habitats and minimize human disturbance. Combined with the forestwide, comprehensive, detailed and specific plan direction the revised plan would provide better protection for, and potential improvement of, sage-grouse populations and associated habitats.

Known sage-grouse use on the Custer Gallatin is currently limited to summer brood rearing by a few individuals, in other words, their presence on the national forest is currently seasonal. The occurrence of past lek locations, combined with currently unoccupied priority and general habitat on the Custer Gallatin, indicates potential for expanded sage-grouse use. Most of the sage-grouse habitat on the Custer Gallatin is located near the edges of Custer Gallatin administrative units, occurring as an extension of suitable habitat from adjacent land of mixed ownership. There is potential for increasing sage-grouse numbers and distribution on the Custer Gallatin thereby supporting the species' long-term persistence in the plan area. However, due to the relatively limited amounts and isolated distribution of sage-grouse habitat, it would support only a small population, which would be vulnerable to ecological stressors from both within and outside the national forest boundary. Therefore, it is likely not within the inherent capability of the plan area to maintain or restore ecological conditions that would support long-term persistence of sage-grouse within the national forest boundary. Sage-grouse persistence across the species' range will require multiple geographically distributed populations to retain redundancy, representation, and resilience (USDI FWS 2013c). Plan components in all revised plan alternatives would maintain or restore ecological conditions within the plan area to contribute toward maintaining long-term persistence of the species within its range.

White-tailed Prairie Dog (*Cynomys leucurus*)

The white-tailed prairie dog is identified as a Regional Forester's species of conservation concern for the Custer Gallatin National Forest. It is one of two species of prairie dog found on the Custer Gallatin. Prairie dogs create habitat conditions favorable for a number of species besides themselves. Prairie dogs influence vegetation composition and structure through their foraging habits, creating conditions favorable for a range of short-grass prairie species. A number of species prey directly on prairie dogs for food, and some species find shelter from weather and predators in prairie dog burrows (Montana Prairie Dog Working Group 2002). White-tailed prairie dogs in Montana are at the very northern tip of the species' range, occurring just north of the Wyoming border, including a small portion of the Custer Gallatin Forest in southern Carbon County (Figure 39). The white-tailed prairie dog was petitioned for listing under the Endangered Species Act. After a review of the best available science in 2010, the U.S. Fish and Wildlife Service determined the species did not warrant listing. This determination was confirmed in a 2017 status review, which found that white-tailed prairie dog populations are in moderate to high overall conditions across the species' range, with trends that are generally stable except for declines due to stochastic events followed by recovery (USDI FWS 2010, Mack et al. 2017).

White-tailed prairie dogs are squirrel-like rodents that dig burrows underground and live in loosely formed colonies. They remain active for five to seven months of the year, and hibernate during winter. White-tailed prairie dogs are typically found at higher elevations than black-tailed prairie dogs (*C. ludovicianus*), which are the other species known to occur on the Custer Gallatin. White-tailed prairie dogs prefer relatively open areas with low vegetation height, but often have dense sagebrush cover nearby to provide protection from predators. They feed primarily on plants such as grasses, forbs, and shrubs, but will also eat a variety of insects. Across their historic range, white-tailed prairie dog distribution has remained relatively constant, but population declines have occurred due to pest control efforts, habitat loss, and disease (such as plague).

Across their range, white-tailed prairie dogs occur in an elevation band between about 3,700 and 10,500 feet. Montana is at the northern extent of white-tailed prairie dog predicted range, with Custer Gallatin National Forest System lands at about mid-elevation for the species at 6,000 to 7,000 feet. Although white-tailed prairie dog distribution has been relatively consistent across the entire range, the notable exception has been in Montana, where white-tailed prairie dogs previously occupied areas to the north of their current distribution (U.S. Department of the Interior 2010). According to monitoring reports for the Custer National Forest Plan, Flath (1979, cited in USDA FS 2000, USDI FWS 2010), mapped the distribution of white-tailed prairie dogs in Montana during the 1970s and found 15 colonies totaling about 773 acres in Carbon County, located on public and private lands. These colonies were resurveyed in 1997 and only two remained occupied, one of which was located partially on National Forest System lands on the Beartooth Ranger District. Conversion of shrub and grassland to agricultural lands and apparent plague have been cited as the likely cause of decline for white-tailed prairie dogs in Montana (Ibid). Habitat conversion for agricultural purposes occurred on private land.

Analysis Area

White-tailed prairie dog range is very limited on the Custer Gallatin National Forest, occurring only in very small areas at the easternmost edge of the Absaroka Beartooth Mountains and westernmost edge of the Pryor Mountains Geographic Areas (figure 39). The area used for this analysis includes the range extent for the species in Montana, including small amounts of National Forest System lands for indirect effects and adjacent lands of other ownership for cumulative effects.

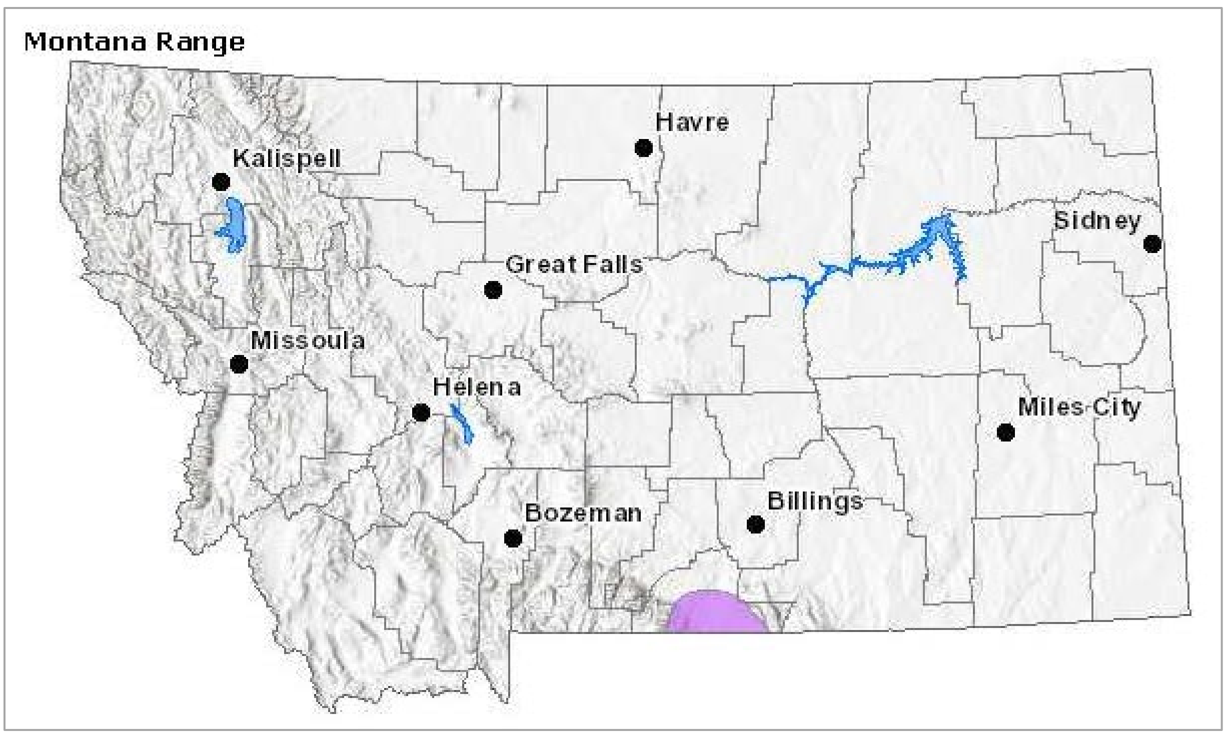

Figure 39. Range map for white-tailed prairie dogs in Montana (Source: Montana Field Guide November 2018 (http://fieldguide.mt.gov/species))

Affected Environment (Existing Conditions)

Prairie dogs in Montana are managed under a state-wide conservation plan (Montana Prairie Dog Working Group 2002). White-tailed prairie dog range is very limited in Montana, occurring primarily in the rolling plains and valley bottoms between the Beartooth and Pryor Mountains Ranges. The portion of the species' range in Montana is only about one percent of the total predicted range for white-tailed prairie dogs. Of that small amount, roughly two percent of the predicted range for white-tailed prairie dogs in Montana is on National Forest System lands located on the Custer Gallatin National Forest (U.S. Department of the Interior 2010). In other words, only about two one-hundredths of one percent of white-tailed prairie dog habitat in the United States is located on the Custer Gallatin National Forest. As of 2017 when last surveyed, the single active white-tailed prairie dog colony on the Custer Gallatin was estimated at approximately 40 acres in size, located near the national forest boundary in the Absaroka Beartooth Mountains Geographic Area. White-tailed prairie dogs are also found near the Pryor Mountains Geographic Area, but to date have all been found entirely on Bureau of Land Management and private lands outside the national forest boundary (Stewart, S. Montana FWP, 2018. pers. comm.).

White-tailed prairie dogs are typically found in relatively dry habitats, within plant communities of mixed shrub and grass species. Their habitat is often dominated by sagebrush interspersed with grass and forb species (Flath and Paulick 1979, cited in http://fieldguide.mt.gov). Habitat is typically found in flat or gently rolling terrain, with lower vegetation height to facilitate predator detection, but also with some dense shrub structure nearby to use as escape cover. Deep, well-drained soils are required for digging burrows (Mack et al. 2017). Generally, prairie dogs do not inhabit areas dominated by coniferous or deciduous trees (Montana Prairie Dog Working Group 2002). Habitat conditions are limited for prairie dogs on the Custer Gallatin National Forest, since most of the National Forest System land is inhospitable due to the presence of trees, greater topographic relief and rocky soils. The area currently occupied by white-tailed prairie dogs is shrub-steppe habitat, dominated by xeric grass and forb species, with naturally sparse (no more than 5 percent) shrub cover. Grass-shrub habitats like this typically fall within a fire regime in which stand-replacing fires burn fairly frequently (0-35 years). Fire has been a natural part of this ecosystem, with the most recent burn occurring in the early 1990s. Invasive plants are present, but currently at low levels with spotty coverage; cheatgrass has yet to firmly establish in the area. Conifer encroachment could become an issue if not managed.

There is substantial evidence that globally, climates are changing, and generally, temperatures are increasing within the range of white-tailed prairie dog. Temperatures are predicted to continue to rise, with possible increases in fire size, severity and frequency. Such changes may affect availability of suitable habitat, and could potentially result in a range shift for white-tailed prairie dogs (USDI FWS 2010).

Public use is relatively light in the portion of the Custer Gallatin currently occupied by white-tailed prairie dogs. Recreation on existing roads and trails is the primary use, but occurs at low levels relative to other parts of the national forest. The small size and remote location of the white-tailed prairie dog colony has not attracted recreational shooting of this species on the Custer Gallatin. There are currently no active livestock grazing allotments on National Forest System lands in this area; however, there is some residual fencing left from past livestock operations. One oil well was established in the general vicinity in the early 1990s, but did not produce as anticipated and has since been capped. Agricultural conversion has not occurred within the national forest boundary in white-tailed prairie dog habitat, but some agricultural conversion and residential development outside the national forest boundary have reduced the total colony size of white-tailed prairie dogs living within the boundary. This includes the recent construction of two private residences just outside the national forest boundary, in an area previously, and perhaps currently, occupied by white-tailed prairie dogs (Stewart, S. Montana FWP, 2018. pers. comm.).

Key Stressors

Disease (such as plague) and habitat loss through conversion for agriculture are the most probable causes for population declines of white-tailed prairie dogs in Montana (USDA FS 2000, Montana Prairie Dog Working Group 2002, USDI FWS 2010).

Agricultural conversion occurs when native plant communities are replaced with exotic species for purposes of producing croplands, pasturelands, or other agricultural products. Such conversion at a large scale represents permanent habitat loss for prairie dogs. In some cases, prairie dogs can coexist with agricultural operations, and may even benefit from highly nutritious forage produced on agricultural lands. However, where prairie dogs are considered a nuisance or threat to agricultural operations, pest control efforts can have negative effects on prairie dog populations. (Mack et al. 2017).

Drought is another potential stressor for white-tailed prairie dogs and their habitats. Drought can affect forage production and quality, which in turn can affect prairie dog body condition, reproductive capability and survival. Drought may also influence plague dynamics in prairie dog colonies, but this relationship is poorly understood. On the one hand, drought can affect prairie dog health, making them more vulnerable to plague infection; while on the other hand, good precipitation benefits primary productivity, which can increase abundance of fleas carrying the plague bacterium (Mack et al. 2017).

Shooting of prairie dogs has been used historically for population control, and is still a popular sport in some areas (USDI FWS 2010).

Poisoning has been widely used as a method of pest control to reduce or eliminate prairie dog colonies, primarily to address perceived conflicts between prairie dogs and livestock. Historic prairie dog control programs reduced the amount of area occupied by prairie dogs, including local extirpations in some areas, resulting in isolation of some colonies (Mack et al. 2017).

Invasive plant species such as nonnative annual grasses and a variety of noxious weeds, can out-compete, and may eventually replace native plant species, thereby altering habitat suitability for prairie dogs by changing vegetative structure as well as forage quantity and quality. In addition to nonnative grasses and forbs, native species such as juniper can also invade shrub-steppe habitats occupied by white-tailed prairie dogs, adding tall structure that is avoided by prairie dogs (Mack et al. 2017).

Fire occurrence and suppression are additional factors that may affect prairie dog habitat. Shrub-steppe habitat favored by white-tailed prairie dogs evolved with fire as a natural disturbance process that occurred at relatively low frequency intervals (Mack et al. 2017).

Climate change has been identified as a factor that could potentially affect white-tailed prairie dogs (USDI FWS 2010). Climate change is expected to affect precipitation, potentially increasing in this area, which could benefit white-tailed prairie dogs through increased forage production. Plague ecology could also be influenced by climate change, but impacts are difficult to predict since plague transmission is positively correlated with rainfall, but negatively associated with overall temperature increases. Warmer winter temperatures could affect plague transmission through reduced periods of prairie dog hibernation and better over-winter survival of plague-carrying fleas (Ibid). In the Greater Yellowstone Area, which is where white-tailed prairie dogs occur on the Custer Gallatin, climate projections indicate that both precipitation and temperature will increase, but that increases in precipitation likely will not offset increases in drying caused by increasing average temperatures (Hansen et al. 2018). Hansen and associates (ibid.) also presented habitat suitability models that project potential replacement of lower elevation Douglas fir forest by sagebrush/juniper communities, which could possibly increase the amount of suitable habitat for white-tailed prairie dogs on the Custer Gallatin. There is a considerable degree of uncertainty in climate change modeling, and these projections are speculative, with low to moderate probability of presenting over the expected life of the plan.

Environmental Consequences

Management Direction under the Current Plans

Prairie dogs are known to occur only on the Custer part of the Custer Gallatin National Forest. The existing Custer Plan addresses prairie dogs without distinguishing between white-tailed prairie dogs and black-tailed prairie dogs, which both occur on the national forest. The current Custer Plan indicates that prairie dogs are to be managed in coordination with other resources, and that prairie dog control measures will be considered to address resources issues. The current plan identifies a maximum of 50 acres of primary suitable range for livestock to be occupied by prairie dogs on the Beartooth Ranger District, which is where white-tailed prairie dogs occur. Before control programs may be approved, the agency must consider factors such as the presence of any threatened or endangered species that could be negatively impacted, environmental implications of control methods proposed, and economic feasibility. The plan also requires consideration for whether proposed control measures would maintain a suitable number of prairie dog towns to provide a reasonable gene pool and adequate distribution of colonies. The plan contains a standard that new roads and facilities will be located at least 100 feet from the edge of prairie dog towns. Finally, the plan calls for monitoring of prairie dog management through surveys. An increase or decrease of 10 percent in the number of prairie dog towns, or a 10 percent increase in acres of prairie dog colonies within domestic livestock grazing allotments are indicated as the level of variation that would initiate evaluation of the need for control.

The Custer Plan identifies sensitive species as those that are susceptible or vulnerable to activity impacts or habitat alterations. In 1993, the plan was amended (Amendment 27) to add both white-tailed and black-tailed prairie dogs as sensitive species known to occur on the Custer National Forest. The Custer Plan defines a biological evaluation as the tool used to review programs and activities for possible effects on sensitive species. Prairie dogs are not known to occur on the Gallatin portion of the national forest, and the Gallatin Forest Plan contains no direction for management of prairie dogs or their habitat.

Effects of the Current Plans

The existing (1986 as amended) Custer Plan contains measures that apply to prairie dog towns, but do not differentiate between white-tailed and black-tailed species. The plan contains direction to provide habitat for prairie dogs in a manner that does not significantly affect the grazing of livestock, with an emphasis on controlling new prairie dog towns at a small size. There are currently no permitted livestock grazing allotments in the area occupied by white-tailed prairie dogs on the Custer Gallatin, and no control measures have been implemented targeting white-tailed prairie dogs under the existing plan. There is no existing plan direction that would prohibit lethal control of white-tailed prairie dogs; however, under the current plans, the species would continue to be addressed as a Regional Forester's sensitive species, so control measures would need to comply with Forest Service Manual direction for maintenance of sensitive species (FSM 2670). The current plan requires that new roads or other facilities be located at least 100 feet from the edge of existing prairie dog towns. This limit was imposed to minimize disturbance of prairie dogs and other species associated with prairie dog colonies.

Recreational shooting, which is more popular at black-tailed prairie dog colonies, may also be a factor limiting the expansion of white-tailed prairie dogs. Recreational shooting of prairie dogs tends to occur within a short distance of occupied burrows. The plan limit on new roads and trails within 100 feet of prairie dog towns may limit the amount of prairie dog mortality associated with recreational shooting. Further, the limit on new structures of any kind within 100 feet of an active colony, reduces the number of artificial perches that may be used by aerial predators of prairie dogs, which also reduces the amount of direct mortality of prairie dogs associated with management actions.

Management Direction under the Revised Plan Alternatives

Under all revised plan alternatives, the plan contains desired conditions that acknowledge the unique contributions of prairie dogs (both species) to habitat conditions required by a variety of prairie-associated plants and animals. Habitat for both white-tailed and black-tailed prairie dogs allows for colony expansion, but black-tailed prairie dog colony expansion does not result in unwanted encroachment onto adjacent non-federal lands. All revised plan alternatives include a goal to engage with state wildlife agencies to coordinate management of prairie dog towns. The revised plan alternatives contain standards that would preclude the use of toxicants (such as rodenticides) for control of white-tailed prairie dog colonies, and like the existing plan, would also prohibit construction of new permanent roads, trails or other facilities and structures within 100 feet of white-tailed prairie dog colonies.

Effects of the Revised Plan Alternatives

Under the revised plan alternatives, desired conditions acknowledge the important ecological contributions of prairie dogs. Accordingly, the Forest may take a more proactive role in managing white-tailed prairie dog habitat to facilitate colony expansion. However, the amount of habitat suitable for white-tailed prairie dogs is somewhat limited on the Custer Gallatin. All revised plan alternatives contain objectives for implementation of projects to benefit at-risk species, which could promote habitat restoration or improvement projects for white-tailed prairie dogs. For example, the targeted removal of conifers encroaching into otherwise suitable prairie dog habitat, or noxious weed treatment to reduce competition for native plant species, could be used to benefit white-tailed prairie dogs. All revised plan alternatives would prohibit the use of toxicants (such as rodenticides) to control the spread of white-tailed prairie dog colonies, and also prohibit the construction of new permanent facilities or structures near white-tailed prairie dog colonies, which combined would limit the amount of prairie dog mortality associated with management actions. The revised plan alternatives include a goal to engage with state wildlife agencies to coordinate management of prairie dog towns. Such coordinated efforts could result in increased size or number of prairie dog colonies, as well as improved health and resilience to disease for white-tailed prairie dogs on the Custer Gallatin National Forest.

Sylvatic plague is an exotic disease that is caused by a bacterium carried by fleas and subsequently transmitted to host animals (such as prairie dogs) through flea bites. Prairie dogs live in colonies and are highly social, so they are more likely to transmit disease amongst themselves than are other rodents. However, white-tailed prairie dog colonies are more loosely organized, less densely populated, and exhibit less social behavior (such as grooming one another) than other species of prairie dogs, and therefore appear to be less susceptible to plague dynamics (Montana Prairie Dog Working Group 2002, Nistler 2009, USDI FWS 2010). Forest management actions have little influence on disease spread amongst prairie dogs. However, the revised plan alternatives all contain a goal to engage with state wildlife agencies to coordinate management of prairie dogs, which could result in cooperative efforts to manage plague outbreaks on the Custer Gallatin and adjacent lands.

Consequences to White-Tailed Prairie Dog from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Terrestrial Vegetation Management

All revised plan alternatives contain desired conditions for grassland and shrubland habitats, including native plant communities that are self-sustaining, non-native species are in check (not increasing) and plant communities support biodiversity. In addition, detailed descriptions are included for plant species composition, structure and conditions that result in healthy, resilient habitats, which support prairie dogs. Refer to the terrestrial vegetation, grasslands, and Shrublands section of the draft environmental impact statement for a more detailed description of existing conditions and environmental consequences of the revised plan alternatives. These desired conditions reflect knowledge of the natural range of variation for grassland and shrubland communities. Achieving desired conditions for grass and shrub habitats would provide over time a range of conditions to which prairie dogs have adapted on the Custer Gallatin. The revised plan alternatives include guidelines to promote habitat heterogeneity and minimize habitat fragmentation, which would benefit prairie dogs. In summary, the revised plan alternatives contain much more detailed, community-specific and ecologically-based direction for management of grass and shrub habitats, which would be more favorable for prairie dog habitat than under existing plan direction.

Effects from Fire and Fuels Management

Fire can reduce vegetation height, thereby increasing visibility for prairie dogs to detect predators. Fire also contributes to nutrient cycling, which is important for plant productivity and forage production. However, intense fire can kill sagebrush, and often favors invasive species, which may perpetuate a more frequent fire cycle. White-tailed prairie dogs use shrubs as forage, as well as escape cover from predators, and severe reductions in shrub cover may have negative impacts on habitat. Fire in late summer or autumn can reduce forage needed by prairie dogs to build fat reserves for winter hibernation (Mack et al. 2017). The revised plan alternatives include desired conditions for wildland fires that burn with a range of intensity, severity and frequency that allows ecosystems to function in a resilient and sustainable manner, which would promote a more natural fire regime that produces conditions favorable to prairie dogs. Fire and fuels direction under all revised plan alternatives include plan components aimed at hazardous fuels mitigation to protect values at risk, particularly in the wildland urban interface. Location of the white-tailed prairie dog colony near the national forest boundary adjacent to private homes lends it to consideration for hazardous fuels mitigation. Common fuel reduction practices such removal of conifers encroaching into the area, or removal of tall, dense grasses that present flashy fuels, would benefit prairie dog habitat, and timing could be used to minimize negative impacts to prairie dogs.

Over time, fire suppression can result in an increase in tree and shrub species in sage-steppe habitats, at the expense of native grass and forb species that provide important forage components for prairie dogs. On the other hand, fire suppression can prevent severe fires from removing important escape cover in white-tailed prairie dog habitat (Mack et al. 2017). Due to the location of the white-tailed prairie dog colony near the national forest boundary and adjacent to private homes, suppression of wildfire would be a high priority if homes were threatened. All revised plan alternatives include a guideline to minimize natural resource damage through use of minimum impact suppression tactics, including habitat for at-risk species such as the white-tailed prairie dog. Given the colony proximity to private homes, increased presence of trees and shrubs would likely be a target for hazardous fuels mitigation under all alternatives.

Effects from Permitted Livestock Grazing Management

Properly managed livestock grazing can benefit white-tailed prairie dogs by reducing vegetation height to enhance visibility and predator detection by prairie dogs. However, overgrazing by livestock can alter vegetation and soils, resulting in negative impacts to prairie dogs. Infrastructure associated with livestock production such as roads, fences, and water developments can fragment habitat, and attract prairie dog predators. Livestock may also compete directly with prairie dogs for preferred forage species, leaving less desirable or unpalatable plant species to flourish, including potential colonization by invasive plant species such as cheatgrass. Overstocking of livestock can result in soil compaction, reducing soil suitability for prairie dog burrows (Mack et al. 2017). There is no livestock grazing currently permitted in the area occupied by white-tailed prairie dogs on the Custer Gallatin. However, short-term use of domestic livestock could be an appropriate tool to reduce existing vegetation height, or for treatment of noxious weeds that compete with native plants that provide forage for prairie dogs. This tool would be available under all alternatives. All revised plan alternatives contain a standard that new or revised allotment management plans include grazing practices that avoid, minimize or mitigate adverse livestock-related effects in both riparian and upland habitats, which would result in proper grazing levels, and minimize impacts from invasive plants and soil compaction in a manner that would benefit white-tailed prairie dogs.

Effects from Recreation Management

The area occupied by white-tailed prairie dogs has road and trail access, with a semi-primitive motorized recreation opportunity class under all alternatives. However, it is immediately adjacent to semi-primitive nonmotorized areas and overall recreational use occurs at low levels and is highly dispersed relative to other parts of the Custer Gallatin National Forest. The primary concern from recreation management would be potential for recreational shooting of white-tailed prairie dogs. Shooting of nongame species such as prairie dogs falls under state jurisdiction, and is largely unregulated in areas occupied by prairie dogs on the Custer Gallatin National Forest. White-tailed prairie dogs are susceptible to unrestricted recreational shooting, but the effects have not been well studied for this species. Lower population density and less social structure of white-tailed prairie dog colonies may discourage recreational shooting (U.S. Department of the Interior 2010). Further, the small size and isolated location of the white-tailed prairie dog colony is unlikely to attract recreational shooting on the Custer Gallatin.

Cumulative Effects

Hunting of wildlife falls under jurisdiction of the states. White-tailed prairie dogs are managed under a conservation plan for prairie dogs in Montana (Montana Prairie Dog Working Group 2002), and are identified as species of concern by the state of Montana. For regulatory purposes, prairie dogs have dual designation of “nongame” status by the Montana Fish Wildlife and parks, as well as “vertebrate pests” by the Montana Department of Agriculture. As such, recreational shooting of prairie dogs is largely unregulated (Montana FWP 2007, Nistler 2009). Although white-tailed prairie dogs are identified as a "species of greatest conservation need" by the state of Montana, they are currently unregulated as a nongame species, and shooting is allowed on public lands, unless covered under a special area closure (Montana FWP 2015a). The revised plan alternatives plan components for prairie dogs are consistent with the conservation plan for prairie dogs in Montana (Montana Prairie Dog Working Group 2002).

The Bureau of Land Management Resource Management Plan for the Billings Field Office considers white-tailed prairie dogs a special status species. In Montana, prairie dog management actions on Bureau of Land Management lands are subject to the conservation plan for prairie dogs (Montana Prairie Dog Working Group 2002), under which white-tailed prairie dogs will be considered a priority for management due to limited and declining populations. The Bureau of Land Management plan prohibits surface occupancy and use for oils and gas exploration and development within ¼ mile of prairie dog colonies active within the past ten years.

Conclusion

In summary, the revised plan alternatives acknowledge the ecological importance of prairie dog communities, and subsequently provide more specific and protective measures for white-tailed prairie dogs than the current plans, including a proactive desired condition to allow for natural colony expansion where suitable, rather than placing limits on allowable acreage of occupation. Under the existing plans, the white-tailed prairie dog would remain on the Regional Forester's sensitive species list. Direction for Forest Service sensitive species management is found in the Forest Service Manual (FSM 2672.32), which mandates that agency decisions must not result in loss of species viability or create significant trends toward federal listing. The U.S. Fish and Wildlife Service has determined that the white-tailed prairie dog is not warranted for federal listing (USDI FWS 2010, Mack et al. 2017).

The 2012 Planning Rule requires that plan components must provide the ecological conditions necessary to maintain long-term persistence of each species of conservation concern within the plan area. The white-tailed prairie dog population on the Custer Gallatin is small, but has remained persistent over time. Due to the small size of the population and limited habitat on the Custer Gallatin for expansion, white-tailed prairie dog is vulnerable to stressors beyond the authority of the Forest Service to manage; most notably the risk of plague spread by fleas. In this case, the plan must provide direction that will contribute to maintaining long-term persistence of the species within its range. Under all revised plan alternatives, plan components provide proactive measures to manage conditions within the authority of the Forest Service to maintain the existing population of white-tailed prairie dogs, and allow for colony expansion. Under all alternatives, habitat would be maintained for the species such that, if the existing population were devastated by disease, the habitat could be recolonized from nearby source populations in Wyoming.

3.10.4 General Wildlife

Bighorn Sheep (*Ovis canadensis*)

Bighorn sheep occur in the mountainous regions of the western United States, including both Montana and South Dakota. They are currently present only in the Montana portion of the Custer Gallatin National Forest. Some have suggested that bighorn sheep historically present in the badlands of eastern Montana and northwestern South Dakota, were a subspecies called Audubon sheep (*O. c. auduboni*). However, since few specimens from the area were available to study, it was difficult to prove distinction to the subspecies level, and debate as to whether a true subspecies existed continues today (Montana FWP 2010).

European settlement of the western United States led to serious declines in bighorn sheep populations at the turn of the 20th century. By 1930, wild sheep were limited to a number of small, remnant bands across their range, and the Audubon subspecies (or race) was extirpated from eastern Montana and South (Montana FWP 2010, South Dakota GFP 2014). Causes cited for population declines include competition with domestic livestock for space and forage, introduced disease, and overharvest from hunting. Other contributing factors included poor range condition, extreme weather events, and native disease outbreaks. Alarm over rapidly declining sheep populations spurred restoration efforts in the 20th century. The distribution of bighorn sheep has improved since then because of improved range management, reduced competition from livestock and other native herbivores, reductions in the presence of domestic sheep and goats, regulated hunting, and implementation of a bighorn sheep transplanting program (Montana FWP 2010). Disease-related die-offs and lowered lamb recruitment periodically affect individual herds throughout the west, including some on the Custer Gallatin (ibid., (Garrott et al. 2015).

Bighorn sheep use a variety of vegetation, elevations, and other conditions that can vary by individual herd, season, and between sex and age cohorts. While variation is common for bighorn sheep, there are habitat components that are particularly important, and consistently used across bighorn sheep range. Escape terrain is a key element in all seasonal bighorn sheep ranges. Escape terrain typically includes steep, rocky slopes that are used by bighorn sheep to escape predation. Most bighorn sheep, but particularly ewes and lambs, are generally found within 100 meters (109 yards), and rarely found more than 300 meters (328 yards) from escape terrain. High visibility is another characteristic of great importance to bighorn sheep, as it is necessary for the detection and avoidance of predators, as well as for locating and accessing suitable foraging areas. Winter range for bighorn sheep is typically found at lower elevations, on southerly aspects with escape terrain available in close proximity to foraging areas. However, some bighorn sheep find suitable winter range at higher elevations where windswept slopes provide access to both forage and escape terrain (DeCesare and Pletscher 2006, MTFWP 2010). Bighorn lambs are born in spring, generally near or at lower elevations than, winter ranges. Lambing areas typically provide warmer slopes (such as southerly exposure), accessible escape terrain, good visibility, and close proximity to good quality drinking water and forage (Montana FWP 2010).

Bighorn sheep are opportunistic foragers, using a wide variety of vegetation types as foraging areas. A key attribute of foraging habitat is proximity to escape terrain and high visibility. Heavily forested areas are typically avoided. Forbs are predominant in spring diets of bighorn sheep, and grasses become more important during summer and fall when forbs dry out and become less available and palatable. Browse species (such as shrubs and trees) may become important in fall and winter with decreasing availability of grasses and forbs (Montana FWP 2010). Recently burned areas may provide new foraging opportunities for bighorn sheep, particularly where pre-fire conditions supported dense tree or tall shrub cover (DeCesare and Pletcher 2006).

Bighorn sheep often persist as a metapopulation, which is a number of subpopulations (or relatively distinct herds) distributed across habitat such that they are connected to some degree by dispersal of individuals between subpopulations. Some degree of habitat connectivity between subpopulations is required to promote dispersal. Metapopulation systems facilitate gene flow to maintain or increase genetic diversity, which generally improves fitness of individuals and populations. However, metapopulation structure can also influence the rate of disease spread between subpopulations (Montana FWP 2010).

Analysis Area

The stronghold for bighorn sheep on the Custer Gallatin is currently, and always has been, the large, relatively contiguous block of habitat contained in the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas. Therefore, these geographic areas will be the focal area for the analysis. However, bighorns occasionally wander into the Pryor Mountains Geographic Area, and there is suitable, but unoccupied habitat for the species in the Bridger, Bangtail, and Crazy Mountains, Ashland, and Sioux Geographic Areas, so these areas will be considered for indirect and cumulative effects as well.

Affected Environment (Existing Conditions)

Bighorn sheep are currently present in the Madison, Henrys Lake, and Gallatin Mountains, Absaroka Beartooth Mountains, and Pryor Mountains Geographic Areas of the montane ecosystem on the Custer Gallatin National Forest; with multiple herds using the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas, and a single herd in the Pryor Mountains Geographic Area. Bighorn sheep presence on the Custer Gallatin is a result of both long-term persistence of native sheep herds, as well as more recent transplants in some areas. Bighorns in the Madison, Henrys Lake, and Gallatin Mountains and Absaroka Beartooth Mountains Geographic Areas are mostly native herds, but there has been some augmentation with transplants. It is likely that individual sheep disperse between herds and interbreeding occurs in the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas. The Pryor Mountains bighorn sheep herd is primarily found outside the Custer Gallatin on lands managed by the National Park Service (Bighorn Canyon National Recreation Area) and Bureau of Land Management, but bighorns occasionally venture onto the national forest in the Pryor Mountains Geographic Area. The Pryor Mountains herd was established through transplants of bighorn sheep from Montana and Wyoming. Wild (feral) horses are present in the Pryor Mountains Geographic Area; however, only a few bighorns, primarily rams, are occasionally found within the wild horse territory on the Custer Gallatin (Montana FWP 2010).

In the late 1800s, bighorn sheep were likely present in the Crazy Mountains of the Bridger, Bangtail, and Crazy Mountains Geographic Area, but were historically absent from the Bridger and Bangtail Ranges. Bighorn sheep are not known historically from the Ashland Geographic Area, but a few individuals have been documented there in the early 2000s (http://mtnhp.org). These sheep were likely from the Blue Hills herd, which was established north of the Ashland Geographic Area by transplant in the late 1950s (Montana FWP 2010). Recent sightings of sheep on the Ashland Geographic Area occurred during extreme fire seasons, possibly due to smoke and fire causing the sheep to roam further than usual. No bighorn sheep have been documented in the Sioux Geographic Area in recent times. The Sioux Geographic Area, and to a lesser extent the Ashland Geographic Area, are currently in close proximity to domestic sheep allotments on Bureau of Land Management land (ibid.).

Individual herd size can vary considerably year to year. While some of the bighorn sheep herds utilizing the Custer Gallatin are robust and frequently number well over 100 animals, others are much smaller. Generally smaller herd sizes and isolation can affect bighorn sheep population health and recruitment. However, higher population growth has been observed for smaller bighorn herds in the Greater Yellowstone Area (including some on the Custer Gallatin), which could be due to density-dependent factors (e.g. competition for resources) limiting growth rates of larger herds (Flesch and Garrott 2012). Loveless (2016) noted strong evidence that disease risk increases at higher bighorn sheep densities in areas of the Custer Gallatin Forest, indicating that smaller herd size and isolation can actually limit potential for disease transmission through greater dispersion of individuals, and limited movement between established herds. Although mixing of herds can benefit genetic diversity of the larger bighorn population, such movement, either through natural dispersal or animal transplants, can also introduce disease, or augment herds with more susceptible individuals (ibid.).

Bighorn sheep habitat in the montane ecosystem of the Custer Gallatin ranges in elevation from about 5,500 feet to over 12,000 feet, and can generally be described as a mosaic of rolling montane foothills, grass, forb, and shrub meadows, open-canopied forested slopes, alpine ridges and basins, steep canyons, and sheer cliffs. Lower elevation badlands in the pine savanna ecosystem may provide suitable habitat, but are currently not occupied by bighorn sheep. Winter range currently occupied by bighorn sheep is a mix of high and low elevation habitats. Some sheep winter on open, wind-swept slopes at higher elevations, while others move to lower elevations where thermal conditions expose more forage. Some herds intermingle on summer range, and move to separate winter ranges. Roughly 47 percent of the Absaroka Beartooth Mountains Geographic Area provides potential bighorn sheep habitat, including 25 percent in grass and forb meadows that provide foraging habitat for summer and winter range, 2 percent in shrublands that provide cover for possible lambing areas, and 20 percent in rock or other sparsely vegetated types that provide potential escape terrain. About 29 percent of the Madison, Henrys Lake, and Gallatin Mountains Geographic Area is potential bighorn sheep habitat, with 14 percent grass and forb cover, 4 percent shrub cover, and 5 percent rock or other non-vegetated areas. The Pryor Mountains bighorn sheep herd is mainly found on lands managed by the Bureau of Land Management and Bighorn Canyon National Recreation Area, but bighorns occasionally venture onto the Forest Service in the Pryor Mountains Geographic Area. The Pryor Mountains Geographic Area is much smaller than the others, but roughly 36 percent of the area is grass and forb habitat, with 2 percent shrub cover, and only 1 percent rock or cliff component. The lack of adequate escape terrain in the Pryor Mountains Geographic Area likely explains why bighorn sheep presence there is limited.

The most important influence on bighorn sheep populations in Montana appears to be disease-related die-off. An extensive review of scientific literature and available data on bighorn sheep populations in the western United States concluded that contact with domestic sheep and goats was the source of most of the disease resulting in major die-offs of bighorn sheep (Wild Sheep Working Group 2012). Domestic sheep and goats may be permitted on National Forest System lands for livestock production, use as bio-control agents to manage infestations of noxious weeds, or use as recreational pack animals. However, there are currently no permitted grazing allotments for domestic sheep or goats, and no permitted outfitter or guide use of pack goats on the Custer Gallatin National Forest. Targeted grazing of domestic sheep and goats has been used for weed treatment in some areas of the Custer Gallatin; however, such use has been deliberately restricted to sites not currently occupied by bighorn sheep. Trespass of domestic sheep and goats may occasionally occur from adjacent lands, but has not been a major issue on the Custer Gallatin. A few individuals have used domestic pack goats for personal (not outfitting or guiding) recreational purposes, but to date, such use has been very limited on the Custer Gallatin National Forest.

Mountain goats are not native to the Custer Gallatin National Forest, but rather were introduced here in the 1940s and 1950s, some in areas of native bighorn sheep habitat. The two species occupy similar habitats, and where they overlap there could be competition for forage and other resources, as well as potential for disease transmission between these species (Flesch and Garrott 2012, Garrott pers. comm. 2016, Wolff et al. 2016). To date, studies conducted on the Custer Gallatin have shown differences in habitat selection and foraging behavior between the species, with little direct competition noted. From 1995 to 2009, bighorn sheep populations on the Custer Gallatin, which are all sympatric with mountain goats, showed stable to increasing populations (Montana FWP 2010, Flesch and Garrott 2012).

Key Stressors

The presence of disease-carrying domestic sheep and goats in close proximity to bighorn sheep is a key stressor for bighorn sheep. Respiratory disease, often transmitted to bighorns from domestic sheep, was identified as a primary cause of mortality in bighorn sheep in the 20th century (Montana FWP 2010, Wild Sheep Working Group 2012). Consequently, comingling of bighorns with domestic sheep and goats continues to be a major concern today (Garrott et al. 2015).

Conifer establishment in previously open areas limits visibility, which reduces suitability for bighorn sheep, can fragment bighorn sheep habitat, and may disrupt traditional migration patterns (Montana FWP 2010).

Noxious weed invasion can alter plant community composition and impact forage availability for bighorn sheep (Montana FWP 2010).

Livestock grazing operations for cattle, horses, or other species not considered a risk for disease transmission can impact bighorn sheep habitat (Montana FWP 2010).

Human disturbance can be a key stressor on bighorn sheep winter range or lambing areas, as such disturbance can cause displacement of sheep, or other behavioral modifications that can deplete energy reserves at crucial times (Montana FWP 2010).

Permanent developments such as residential areas or resorts, recreation facilities, paved roads and highways, dams, large mining operations, and energy developments, can affect bighorn sheep through loss or fragmentation of habitat, disruption of migratory corridors, mortality from vehicle collisions, harassment by domestic pets, and displacement to less suitable habitats (Montana FWP 2010).

Environmental Consequences

Management Direction under the Current Plans

The Custer Plan directs that special consideration be given for bighorn sheep, indicating that activities may be restricted during key timing periods for herds using the Custer Gallatin National Forest. The Custer Plan specifies that vegetation manipulation will be used to increase the abundance and vigor of bighorn sheep forage species, but that mechanical methods resulting in surface disturbance are not allowed for such projects on bighorn sheep winter range. The existing plan resulted in closure of the only domestic sheep allotment that was in the Custer portion of the Absaroka-Beartooth wilderness, which is an area that has been a stronghold for bighorn sheep on the Custer Gallatin.

The Gallatin Plan acknowledges the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area as home to an important population of bighorn sheep, with an associated goal to maintain and enhance bighorn sheep habitat and a standard to manage the lambing area. The Gallatin plan also incorporates by reference management direction from the 1982 “Absaroka-Beartooth Wilderness Management Plan,” which requires monitoring of bighorn sheep populations, and coordination of land uses that could negatively impact bighorn sheep in the wilderness area. Finally, the Gallatin plan prohibits stocking of domestic sheep in grazing allotments within the grizzly bear recovery zone and primary conservation area. This restriction applies to roughly 44 percent of the Madison, Henrys Lake, and Gallatin Mountains and the Absaroka Beartooth Mountains Geographic Areas, which contain bighorn sheep.

Bighorn sheep are currently identified as a Regional Forester's sensitive species known to be present on both the Custer and Gallatin portions of the Custer Gallatin National Forest. Under both existing plans, habitat management for sensitive species is subject to special management considerations, as outlined in the Forest Service Manual (FSM 2670).

Effects of the Current Plans

Respiratory disease epidemics are perhaps the primary limiting factor for bighorn sheep populations, and research has confirmed that domestic sheep and goats may carry some of the same strains of disease, and can transmit disease to bighorn sheep in the wild. Separation between domestic and wild sheep is considered an effective way to reduce the risk of disease transmission between domestic and wild species (Montana FWP 2010, Wild Sheep Working Group 2012). Under the existing plans, there have been no permitted livestock grazing allotments stocked with domestic sheep or goats on the Custer or Gallatin for over 20 years. Bighorn sheep on the Custer Gallatin carry known disease pathogens, and have experienced respiratory disease epidemics. Some, but not all herds found on the Custer Gallatin have experienced disease-related die-offs, but affected herds generally have recovered either naturally or through population augmentation (Montana FWP 2010, Garrott et al. 2015).

Under existing plans, domestic sheep and goats could be permitted on grazing allotments in some areas where disease transmission between domestics and wild sheep could occur. The Gallatin plan would prohibit stocking of domestic sheep in livestock allotments inside the grizzly bear recovery zone and primary conservation area, but has no such prohibition elsewhere, and bighorn sheep occupy areas outside the grizzly bear recovery zone. While there is no existing direction specifically addressing disease transmission between domestic sheep and goats and bighorn sheep, both plans contain management direction to maintain or enhance bighorn sheep habitat. Further, both plans contain language for management of sensitive species, and the bighorn sheep is currently on the Regional Forester's list of sensitive species for both the Custer and Gallatin Forests. Although the plans themselves may not specifically prohibit stocking of domestic sheep on permitted grazing allotments in some areas where bighorn sheep may be present, manual direction for Forest Service sensitive species would likely preclude authorization of domestic sheep or goat grazing permits where such activity would present a high risk of disease transmission to bighorn sheep. Current plans do not specifically address the primary threat of disease transmission from domestic sheep or goats to bighorn sheep. However, other directives are in place that would minimize risk of disease transmission from livestock to bighorn sheep under the existing plans.

Management Direction under the Revised Plan Alternatives

All revised plan alternatives include desired conditions for habitat that supports robust bighorn sheep populations that can, if necessary, serve as source populations for augmentation elsewhere, and that bighorn sheep do not intermingle with, or contract contagious disease from, domestic livestock. With these conditions in mind, the revised plan alternatives include a goal for cooperation and collaboration with Tribal governments, state wildlife management and livestock health agencies, livestock permittees, and other interested parties to develop livestock management protocols and habitat management strategies to minimize risk of disease transmission between domestic livestock and bighorn sheep. In order to prevent disease transmission from domestic animals to wild sheep, the revised plan alternatives include a suite of plan components that address permitted grazing of domestic sheep and goats on National Forest System lands for livestock production, outfitter and guide use (pack animals), recreational use and bio-control of invasive plants. These plan components vary by alternative as follows.

Under alternatives B and C, stocking of permitted grazing allotments with domestic sheep or goats for livestock production or recreational packing would not be allowed in the Absaroka Beartooth Mountains, Madison, Henrys Lake, and Gallatin Mountains, or Pryor Mountains Geographic Areas, and these geographic areas would not be suitable for recreational packing of domestic goats by the general public. Permits could be issued for sheep and goat grazing allotments in the Bridger, Bangtail, and Crazy Mountains, Ashland and Sioux Geographic Areas if risk of disease transmission could be effectively mitigated. Targeted grazing by domestic sheep or goats for weed control could be used anywhere on the Custer Gallatin, so long as mitigation measures could effectively minimize risk of disease transmission from domestic animals to wild sheep.

Under alternative D, stocking of permitted grazing allotments with domestic sheep or goats for livestock production or recreational packing would not be allowed anywhere on the Custer Gallatin, and the entire national forest would not be suitable for recreational packing of domestic goats by the general public. Targeted grazing by domestic sheep or goats for weed control could be used anywhere on the Custer Gallatin in the current plans and alternatives B, C and E, so long as mitigation measures could effectively minimize risk of disease transmission from domestic animals to wild sheep. This use would not be allowed in alternative D.

Under alternative E, stocking of permitted grazing allotments with domestic sheep or goats for livestock production, recreational packing, or biological control of invasive plants, could occur only if mitigation measures could effectively minimize potential for disease transmission between domestic livestock and wild sheep.

Under all revised plan alternatives, permitted grazing of domestic sheep would be precluded inside the recovery zone and primary conservation area for grizzly bears, except for the targeted use of domestic sheep for the express purpose of weed control in the current plans and alternatives B, C and E. The grizzly bear recovery zone and primary conservation area covers roughly 44 percent of the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas.

Effects of the Revised Plan Alternatives

All revised plan alternatives include a suite of plan components to directly, specifically, and clearly address the threat of disease transmission from domestic livestock to bighorn sheep. All revised plan alternatives include desired conditions for habitat that supports healthy bighorn sheep populations that do not intermingle with, or contract disease from, domestic livestock. These alternatives also contain a goal to collaborate with partners to develop cooperative management protocols and strategies to minimize risk of disease transmission between livestock and wildlife. All revised plan alternatives include a range of standards that require mitigation based on risk assessment to effectively minimize potential for disease transmission between domestic livestock and bighorn sheep, whether it be for permitted grazing of domestic sheep or goats for livestock production, outfitter use as pack animals, or targeted use for weed control.

Alternatives B and C would minimize risk of disease transmission from domestic livestock to existing bighorn sheep populations, because stocking of permitted grazing allotments with domestic sheep or goats for livestock production or recreational packing would not be allowed in the Absaroka Beartooth Mountains, Madison, Henrys Lake, and Gallatin Mountains or Pryor Mountains Geographic Areas where wild bighorn herds are currently located. Use of pack goats by the general public would also be restricted in the Absaroka Beartooth Mountains; Madison, Henrys Lake, and Gallatin Mountains; and Pryor Mountains Geographic Areas, since these geographic areas would be classified as unsuitable for this use under alternatives B and C. Under these same two alternatives, domestic sheep and goats could be permitted on grazing allotments for livestock production as well as pack goats for recreational outfitting or guiding in the Bridger, Bangtail, and Crazy Mountains, Ashland, and Sioux Geographic Areas, but only if a risk assessment indicates that physical separation or other mitigation can effectively minimize the risk of disease transmission between livestock and bighorn sheep.

Under alternatives B, C and E, targeted grazing by domestic sheep and goats could be used anywhere on the Custer Gallatin for purposes of weed control, but only if a risk assessment indicates that mitigation could effectively prevent disease transmission between livestock and bighorn sheep. These alternatives would require written instructions included in permits, contracts or agreements for weed control to address the management, retrieval and disposition of stray or deceased domestic animals. This allowance was made to acknowledge that invasive weeds are a threat to habitat for bighorn sheep, as well as other wildlife and plant communities, and targeted grazing by domestic sheep and goats has proven to be an effective means of controlling weed spread. Use of domestic livestock grazing for targeted weed control lends itself well to tight restrictions on timing, number of animals, location of use, and oversight requirements, so risk of contact with bighorn sheep could be effectively minimized.

Alternative D would not allow stocking of permitted grazing allotments with domestic sheep or goats for livestock production or outfitter and guide use across the entire forest, and would classify the entire forest as unsuitable for recreational goat packing by the public. Further, the use of domestic sheep or goats for weed treatment would not be allowed anywhere on the Custer Gallatin. This alternative expands the prohibition of domestic sheep and goats to recognize that bighorn sheep were historically present across most of the Custer Gallatin. Bighorn sheep are capable of long-distance dispersal movements, and the Bridger, Bangtail, and Crazy Mountains, Ashland, and Sioux Geographic Areas are all within possible dispersal distance of existing bighorn sheep herds. Restricting domestic sheep and goat presence on National Forest System lands where bighorns are not currently established, would serve to better maintain the suitability of these areas for possible future recolonization by bighorn sheep, whether by natural dispersal or through deliberate transplants.

Alternative E would allow stocking of permitted grazing allotments with domestic sheep or goats anywhere outside the grizzly bear recovery zone and primary conservation area on the Custer Gallatin, so long as a risk assessment indicates that spatial or temporal separation or other mitigation can effectively minimize risk of disease transmission between livestock and bighorn sheep. This alternative allows more flexibility for domestic livestock grazing and recreational use of pack animals, but increases risk of disease transmission to bighorn sheep, given that bighorn sheep are capable of long-range movement, and could come into contact with domestic livestock in areas otherwise considered to be very low risk.

South American camelid species such as llamas and alpacas are popular recreational pack animals that can have lower impacts on fragile environments than other species of pack animals. There is some question as to whether llamas and alpacas pose a threat of disease transmission to wild bighorn sheep. The Centre for Coastal Health (2017) examined the risk for disease transmission from llamas and alpacas to bighorn sheep and other wild ungulates in British Columbia, Canada. This research found no peer-reviewed publications verifying disease transmission from llamas or alpacas to wild bighorn sheep or mountain goats, but cautioned that lack of documentation does not prove that transmission has not, or could not occur. The authors concluded there is a high degree of uncertainty regarding the probability of disease transmission from llamas and alpacas to bighorn sheep. Llamas and alpacas are used at low levels for recreational packing on the Custer Gallatin National Forest, with no known or suspected disease transmission to wild sheep or goats. Until more definitive science verifies disease transmission from llamas and alpacas to bighorn sheep in the wild, the Custer Gallatin would track this issue relative to the forestwide desired condition for low or no disease transmission between domestic livestock and wildlife, under all revised plan alternatives.

Consequences to Bighorn Sheep from Forest Plan Components Associated with Other Resource Programs or Management Activities

Effects from Terrestrial Vegetation Management

All revised plan alternatives contain desired conditions for grassland and shrubland habitats, including native plant communities that are self-sustaining, non-native species are in check (not increasing), and plant communities support biodiversity. Compared to the existing plans, desired conditions under the revised plan alternatives include greater detail about vegetation conditions, including plant species composition, structure, and function. Such details provide better information for management of grassland and shrubland communities to contribute to biodiversity and ecological integrity of these habitats, and to maintain, restore, or improve resilience to environmental stressors. A more detailed analysis of effects to grasslands and shrublands can be found in the Terrestrial Vegetation section of the draft environmental impact statement.

Conifer encroachment into grasslands, shrub-steppe, or alpine areas limits visibility, and reduces habitat suitability for bighorn sheep (Montana FWP 2010). Conifer encroachment can result from natural succession, but may also be facilitated by fire suppression efforts. All revised plan alternatives include a desired condition that encroachment of conifers is limited and grasslands are maintained by high-frequency, low-severity fire regime (FW-DC-VEGNF), but also include guidelines (FW-GDL-VEGNF) that allow directed removal of conifer encroachment in coordination with other resource needs. One such guideline indicates that conifers should be retained on big game winter range to provide snow intercept, hiding cover and thermal regulation for big game (FW-GDL-WLBG). At face value, this guideline may seem contrary to best science for managing winter range conditions for bighorn sheep. However, the guideline applies to multiple big game species, acknowledging that conifer cover is important to some big game species on winter range. An exception to the guideline specifically allows for cases where benefits to big game species associated with conifer removal outweigh negative impacts of reducing snow intercept, hiding and thermal cover, which would allow for conifer removal on bighorn sheep winter range where needed.

Invasive plant species such as non-native annual grasses and noxious weeds can have negative effects on bighorn sheep habitat by altering forage quantity and quality and influencing fire behavior patterns. All revised plan alternatives include desired conditions for low or no invasive plant species on a landscape dominated by native plant species, with a suite of standards and guidelines that require measures to minimize risk of noxious weed introduction or spread. While the revised plan alternatives contain more specificity about desired plant species composition and specific mitigation for reducing risk of new noxious weed infestations or spread of existing sites, existing plans also encompass best management practices, and the revised plan alternatives provide similar guidance for management of invasive species (see invasive species section of the draft environmental impact statement for more detailed analyses of invasive plants). Under similar direction, the effects from non-native plant invasion in bighorn sheep habitat would be similar under all alternatives; however, alternative E contains a lower weed treatment objective than other alternatives.

Effects from Fire and Fuels Management

All revised plan alternatives include desired conditions in which wildland fires burn with a range of intensity, severity, and frequency that allows ecosystems to function in a resilient and sustainable manner. Bighorn sheep on the Custer Gallatin National Forest have adapted to habitat conditions largely shaped by wildfire over time. Under all alternatives, wildland fires would continue to support the diversity of vegetation on the Custer Gallatin, and would retard conifer encroachment into grassland, meadows and park-like habitats that support bighorn sheep in all seasons. All revised plan alternatives include objectives for wildfire to occur at a larger scale than has been the case under existing plans, which could benefit bighorn sheep habitat by reducing conifer encroachment into grasslands, maintaining or restoring forage conditions, and maintaining open views for bighorns to detect predators. To support this objective, all revised plan alternatives include a guideline that wildfire should be used to meet desired conditions for vegetation and other resources where conditions permit.

Fire suppression has been cited as a possible cause of conifer encroachment into bighorn sheep habitat (Montana FWP 2010). All revised plan alternatives acknowledge the important ecological role of fire and accordingly set the stage for more and better use of wildland fire as tools to move vegetation towards desired conditions compared to the current plans. Increased fire on the landscape would promote biodiversity and ecological integrity, potentially increasing resilience of bighorn sheep habitat to environmental stressors such as conifer encroachment, drought and habitat fragmentation. The revised plan alternatives include a guideline for use of minimum impact fire suppression tactics in sensitive areas, which may include alpine habitats that support bighorn sheep.

Invasive species such as cheatgrass may alter fire behavior patterns in grasslands and shrublands that comprise bighorn sheep habitat. Wildfires would continue to be a major habitat driver under all alternatives, although there is considerable uncertainty as to the extent and distribution of wildfire events. Effects of wildfire on spread of invasive plant species is a concern for bighorn sheep habitat, and these effects would likely be the same across all alternatives.

Effects from Land Allocations

Bighorn sheep wintering areas inside designated wilderness areas would have similar, and low impacts from recreation use under all alternatives. Forest plan allocations and associated recreation opportunity spectrums could influence recreation impacts to bighorn sheep. Alternatives B and C would create recommended wilderness areas that overlap some bighorn sheep wintering areas in the Lionhead, Gallatin Crest, and Sawtooth Mountain area in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area. Alternative D includes these same recommended wilderness areas in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area, and adds recommended wilderness areas overlapping bighorn sheep wintering areas in the East Rosebud and Line Creek areas of the Absaroka

Beartooth Mountains Geographic Area. Forest plan allocation as recommended wilderness may result in slightly lower winter human use levels in alternatives C and D, because forest plan designation as recommended wilderness would change the winter recreation opportunity spectrum class in these areas from semi-primitive nonmotorized to primitive, whereas under alternatives B, the recreation opportunity class would remain as semi-primitive nonmotorized in recommended wilderness areas. Alternatives C and D then may result in slightly lower use levels compared to other alternatives, there would be fewer amenities such as signs and bridges. Alternative E contains no recommended wilderness areas, but rather would create backcountry areas in conjunction with some bighorn sheep winter range. However because the winter recreation opportunity spectrum class would not change with backcountry areas, winter recreation use would remain the same for alternative E as the existing condition.

All revised plan alternatives would include a recreation emphasis area along the Gallatin River corridor, which abuts important bighorn sheep winter range. There is not much winter recreation on the Custer Gallatin associated with this corridor, and the major issue for wintering bighorn sheep in this area is from collisions with vehicles, rather than from recreation on the Custer Gallatin. However, the Gallatin River corridor is a major access route for winter recreation on the national forest, as well as winter recreation at private resorts like Big Sky and Moonlight Ski Areas. The designation of this corridor as a recreation emphasis area would likely have little additional effect on bighorn sheep, but sheep mortality from vehicle collisions along this corridor remains an issue under all alternatives. All revised plan alternatives include a goal (infrastructure – roads and trails) for forest cooperation with highway managers, State agencies, Tribes, and landowners to create wildlife crossing features that reduce vehicle collisions with wildlife. Alternatives B, C and E include a winter recreation emphasis area south of Hebgen Lake that overlaps a small amount of bighorn sheep winter range. While alternative D does not include this winter recreation emphasis area, it makes no forest plan allocation for the area that would change the nature of winter recreation use relative to other alternatives, including the current plans. Since the overlap between bighorn sheep winter range and forest plan allocations for recreation emphasis areas is small, and these allocations generally do not change the recreation opportunity spectrum, the effects would be similar under all alternatives.

Effects from Permitted Livestock Grazing

Improper grazing of cattle and horses can result in overutilization, which can affect forage availability for wild sheep, and livestock fences can affect bighorn sheep movement patterns (Montana FWP 2010). Grazing utilization standards in existing plans have minimized areas where improper livestock grazing has affected bighorn sheep forage. In fact, a livestock grazing system was established on bighorn sheep winter range in one area of the Custer Gallatin for the purpose of improving bighorn sheep winter forage (ibid.). While standards in existing plans have been largely compatible with bighorn sheep habitat management strategies, current plans do not directly address the primary threat of disease transmission from domestic sheep and goats to bighorn sheep. The revised plan alternatives clearly and affirmatively address this threat. Alternatives B and C would prohibit establishment of domestic sheep and goat grazing in the Absaroka Beartooth Mountains, Madison, Henrys Lake, and Gallatin Mountains and Pryor Mountains Geographic Areas where bighorn sheep currently exist, while alternative D would restrict future domestic sheep and goat presence across the entire forest. Alternative E would allow new grazing allotments for domestic sheep and goats, but only if risk of disease transmission can be minimized through effective mitigation. Alternatives B, C and E clearly spell out conditions for targeted grazing of domestic sheep and goats for weed treatment, whereas this use is not allowed under alternative D. Effects of these changes were addressed above.

In addition to addressing concerns about disease transmission, all revised plan alternatives incorporate desired conditions for grazing allotment use that maintains vegetation within, or moves vegetation toward desired ecological conditions, which would benefit bighorn sheep by limiting livestock grazing impacts on wild sheep forage. The revised plan alternatives contain plan components for grazing practices to minimize negative impacts on both riparian and upland habitats, meet big game forage needs, and locate fences to minimize collision hazards and prevent barriers to wildlife movement. These plan components in the revised plan alternatives address a number of factors relevant to bighorn sheep that are not directly addressed in existing plans.

Effects from Energy and Minerals Management

Industrial developments such as hard rock mining, oil and gas exploration and leasing, and power transmission lines, can result in direct loss of bighorn sheep habitat, displacement of sheep due to activity-related disturbance factors, and habitat fragmentation of existing habitats (Montana FWP 2010).

While energy and minerals development on National Forest System lands can have negative impacts on bighorn sheep and their habitats, certain activities such as the right to prospect and explore public lands open to mineral entry, are guaranteed under the Mining Law of 1872. Leasable commodities such as oil and gas, have greater management flexibility for imposing design criteria favorable to wildlife habitat and other resource needs. All revised plan alternatives include multiple standards that require resource considerations for energy and mineral development, including a requirement for reclamation plans with provisions to return disturbed areas to stability and land use comparable to adjacent lands and pre-operational site conditions. Reclamation measures can notably improve bighorn sheep habitat impacted by mining operations, as evidenced by bighorn sheep abandonment of traditional native ranges to winter on reclamation sites in the Stillwater mining complex area. Reclamation sites can provide suitable, if temporary habitat for bighorn sheep. However, reclamation sites that are small can result in concentrated sheep use, which can increase the risk of density-related disease transmission among the sheep (Montana FWP 2010).

The Stillwater mining complex is the only major minerals management currently overlapping occupied bighorn sheep range on the Custer Gallatin Forest. This area has shown high potential for mineral development, and would receive forest plan allocation to recognize such use in alternatives B, C and E. The area is used primarily for mineral development under the existing Custer and Gallatin forest plans as well (alternative A). Under these alternatives, mineral development would be expected to continue and perhaps expand, as a recognized land use in the Stillwater mining complex area, with associated impacts to bighorn sheep habitat. Under alternative D, there would be no forest plan allocation for mining purposes, but mining operations would be expected to continue at existing levels. Under alternative D, some of the area with minerals emphasis under alternatives B, C and E, would be allocated as recommended wilderness. Under certain circumstances, access for mineral operations would still be allowed under existing laws in recommended wilderness (mineral encumbrances section of the draft environmental impact statement provides further details). However, additional mitigation measures to protect resources, such as location of facilities and timing of use, may be imposed on any new proposals for minerals or energy development within the recommended wilderness. Generally small herd size and isolation from other bighorns can affect reproductive recruitment, genetic diversity and population dynamics (Garrott et al. 2015, Montana FWP 2010). The Stillwater bighorn sheep herd has some evidence of inbreeding, likely due to the small herd size, limited exchange with neighboring herds, and possibly impacts from establishment of the Stillwater mine (Garrott, R. pers. comm. 2016). While smaller herds may suffer from genetic isolation, there may be benefits in terms of less competition for resources and reduced potential for disease transmission. Alternative D would have the least potential for impacts associated with mineral development that could further isolate the Stillwater bighorn sheep herd.

Effects from Recreation Management

Disease transmission from recreational use of domestic pack goats is a potential threat to bighorn sheep. Besser and associates (2017) found that while domestic goats carry disease that can be transmitted to bighorn sheep, the severity of disease impacts on wild sheep populations was milder than impacts from disease transmitted from domestic sheep. This being the case, these authors cautioned that there is still uncertainty as to whether there are more virulent strains of disease present in domestic goats, or other factors yet to be considered. The revised plan alternatives address this potential threat, whereas the existing plans do not. Alternatives B and C would not allow special use permits for outfitter and guide use of pack goats in the Absaroka Beartooth Mountains, Madison, Henrys Lake, and Gallatin Mountains or Pryor Mountains Geographic Areas where bighorn sheep currently reside. These geographic areas would also be unsuitable for pack goat use by the public under alternatives B and C. Alternative D would prohibit use of recreational pack goats by outfitters, guides and the public across the entire forest. These alternatives would all ensure that there is little or no risk of disease transmission to bighorn sheep from domestic pack goats on the Custer Gallatin. Alternative D would ensure that all areas of the Custer Gallatin National Forest are free from potential disease vectors in pack goats so that recolonization by bighorn sheep could occur with minimal risk of domestic disease sources. Alternative E would allow issuance of special use permits for pack goat use by outfitters and guides, so long as the risk of disease transmission to bighorn sheep could be minimized through appropriate mitigation measures. Alternative E would allow recreational use of pack goats.

Recreational and resort developments can result in permanent loss or fragmentation of bighorn sheep habitat, and associated human use can cause displacement of wild sheep into less suitable habitats. Human disturbance on important seasonal ranges such as winter range and lambing areas can have negative impacts on bighorn sheep populations (Montana FWP 2010). Many of the bighorn sheep winter ranges on the Custer Gallatin Forest are in designated wilderness, where there are no major developments, and recreational use is limited to nonmotorized activities. Winter access is limited in these areas, and nonmotorized activities generally have a relatively small footprint on bighorn sheep winter range in wilderness areas. The Red Lodge Mountain and Lone Mountain are alpine and Nordic ski areas (respectively) operating under special use permit on the Custer Gallatin. These areas are within or near bighorn sheep range; however, permitted facilities on National Forest System lands do not overlap with bighorn winter range or lambing areas.

Cumulative Effects

The Montana Department of Transportation plan includes a goal for a transportation system that protects the natural environment. This plan shows that wildlife crossings and barriers are top priorities, and also indicates that winter roadway maintenance is a major part of the department’s program. There is little information to suggest that two-lane gravel roads with low traffic volume and speed have major impacts on bighorn sheep or their habitats. These secondary roads make up the vast majority of roads on National Forest System lands. On the other hand, highways can have major impacts on bighorn sheep, primarily as a result of direct mortality caused by vehicle collisions with sheep, but also due to habitat fragmentation and barriers to movement between wild sheep populations. Highways tend to be in close proximity to bighorn winter range on the Custer Gallatin, and winter maintenance such as salting the road surface to reduce snow and ice, can increase the impact on bighorns, as sheep may be attracted to the salt, increasing the risk of vehicle collisions with sheep.

Big Sky and Moonlight Basin are private ski areas within bighorn sheep range. Resort and residential development associated with these areas has resulted in direct loss of bighorn sheep habitat including winter range. These areas attract thousands of visitors for year round activities, a draw that results in high density traffic on U.S. Highway 191 through Gallatin River Canyon, which travels through bighorn sheep winter range. Vehicle collision with bighorn sheep along this highway is a major mortality factor for native bighorn sheep in the Spanish Peaks Range (Montana FWP 2010).

Montana Fish Wildlife and Parks developed a Bighorn Sheep Conservation Strategy in 2010. This document contains recommendations for domestic sheep and goat management in wild sheep habitat, many of which were adopted by all revised plan alternatives for the Custer Gallatin Forest Plan.

The Beaverhead-Deerlodge and Shoshone National Forests are adjacent to areas occupied by bighorn sheep on the Custer Gallatin. There are no domestic sheep allotments in either of these forests in areas adjacent to the Custer Gallatin, but some domestic sheep grazing is still authorized in the plans. The Beaverhead-Deerlodge Forest Plan (2009) includes a standard to close domestic sheep allotments that become vacant in the Gravelly Range, or issue use to existing permittees, which would maintain or possibly reduce numbers of domestic sheep on this forest. The Shoshone Forest Plan (2015) does not allow domestic sheep or goats in areas of core bighorn sheep habitat, which is compatible with proposed plan components in the Custer Gallatin revised plan alternatives.

Bureau of Land Management policy is to achieve effective separation of authorized domestic sheep or goats from wild sheep on Bureau of Land Management lands and to minimize the risk of contact between the species, which is consistent with direction proposed in the revised plan under all revised plan alternatives. However, existing presence of domestic sheep on Bureau of Land Management lands adjacent to the Custer Gallatin could preclude reintroduction of wild bighorn sheep into historic range on the Sioux Geographic Area.

The general management plan for Yellowstone National Park calls for preserving natural resources, including natural vegetation, landscapes and disturbance processes. Grazing of domestic livestock and use of domestic goats as pack animals are prohibited in Yellowstone Park, which is consistent with management direction for adjacent Custer Gallatin lands under all alternatives for grizzly bear habitat, and alternatives B, C and D for bighorn sheep.

Conclusion

The primary issue driving bighorn sheep populations on the Custer Gallatin National Forest and surrounding areas is major die-offs associated with disease spread among and possibly between herds. Although wild sheep can carry disease and transmit to others, many of the same diseases can be carried by domestic sheep and goats, and can be transmitted to wild sheep. All revised plan alternatives acknowledge and address this treat by providing specific direction for minimizing risk of disease spread from domestic sheep and goats to bighorn sheep, which is an improvement compared to the current plans. By limiting presence of domestic sheep and goats on the Custer Gallatin, alternatives B and C minimize risk of disease spread in the geographic areas that are currently occupied by bighorn sheep. Alternative D goes a step further and limits presence of domestic sheep and goats across the entire forest, maintaining a low-risk status for bighorns on current range as well as historic ranges that may be recolonized by wild sheep. Alternative E would allow stocking of domestic sheep and goats anywhere on the Custer Gallatin outside the grizzly bear recovery zone and primary conservation area, with appropriate mitigation. Alternative D goes furthest in terms of minimizing risk of disease transmission, and also has the highest level of forest plan allocation for recommended wilderness, that would place the most restrictions on management actions in bighorn sheep habitat. While establishing new recommended wilderness might result in some changes in recreation impacts on bighorn sheep wintering ranges as described above, such changes would be very minor, since sheep winter range is generally already in areas limited to semi-primitive, nonmotorized use, with controlled access. On the other hand, recommended wilderness allocation would limit tools available to implement habitat improvement projects, such as conifer reduction on bighorn sheep ranges.

Big Game (Elk, Moose, and Deer)

Big game species have a key ecological role on the Custer Gallatin National Forest. Large ungulates can influence vegetation structure, composition and distribution through effects of hoof action, horning and herbivory. Big game species contribute to nutrient cycling through deposition of waste materials and decomposition of large carcasses. They provide an important prey base for predators as well as large carcasses that can feed many scavengers. In addition to these important ecological functions, big game species provide hunting opportunities that contribute to local, regional and national economies. Big game populations and associated hunting regulations are managed by Montana Fish Wildlife and Parks, and South Dakota Game Fish and Parks. The Custer Gallatin Forest supports a wide range of big game species, including elk, moose, deer, pronghorn antelope, bison, bighorn sheep, mountain goat, wild turkey (*Meleagris gallopavo*), black bear (*Ursus americanus*), and mountain lion. Of these, elk, deer and moose are the primary hunted species on the Custer Gallatin and will be the focus of this analysis. Most big game species on the Custer Gallatin tend to be habitat generalists. An assumption was made that addressing the needs of elk, moose, and deer, which are basically habitat generalists with traits and needs that both overlap and differ from each other, the needs of big game species across the Custer Gallatin would be largely addressed, with the exception of bison and bighorn sheep, which are addressed separately in this analysis.

The 2012 Planning Rule requires development of plan components that provide ecological conditions to sustain ecosystems that maintain the diversity of plant and animal communities and the persistence of native species in the plan area (36 CFR 219.9). For most wildlife, including most big game species, a coarse-filter approach that maintains or restores key ecological characteristics, such as species composition, structure, function, and connectivity of vegetation communities, provides habitat conditions required to support most wildlife needs. The planning rule requires fine-filter, or additional, species-specific plan components, only if needed to provide the ecological conditions necessary to address specific needs of at-risk species. None of the big game species that are hunted on the Custer Gallatin Forest is an at-risk species, so no additional plan components are required. However, there is a great deal of public and agency interest in big game species, and a considerable body of science relative to habitat management for these species. Coarse-filter habitat components associated with water and terrestrial vegetation management provide for most habitat needs of big game species, but fine-filter plan components were added to address more site-specific needs associated with habitat security, winter range, and reproductive habitat.

Analysis Area

This analysis was conducted at the forestwide scale, as big game species occur across the entire Forest. Habitat connectivity between Custer Gallatin administrative units is addressed separately in this analysis; therefore, big game habitat was analyzed primarily within the national forest boundary. However, for habitat issues like security that can be affected by factors outside the boundary, a buffer of roughly one-half mile outside the boundary was examined. Information was presented by geographic area where differences were notable, or where breaking down information was informative.

Affected Environment (Existing Conditions)

Unless otherwise noted, the affected environment described herein focuses on conditions for elk, moose, and deer.

Populations

With the exception of moose, these big game populations on the Custer Gallatin National Forest have generally increased in number and distribution since the original forest plans were finalized in the mid-1980s. According to the state wildlife management agencies, big game population trends are generally strong in the vicinity of the Custer Gallatin National Forest. Elk populations are currently (as of 2018) above state management objectives in 11 of the 15 units reported in Montana that fall within the Custer Gallatin National Forest. Another three of the units are within state population objectives, and only one (HD 310) is currently below the state objective level. Elk numbers in Hunting District 310, which is in the upper Gallatin River drainage, began declining early in the 21st century, when a portion of the herd began leaving the Gallatin Valley to occupy private lands in the Madison Valley during winter (Cunningham 2014). Herd numbers in this district have not recovered, but are increasing. The largest proportional growth for elk herds has occurred in the pine savanna ecosystem where elk numbers are currently 3 to 4 times over state population objections for the Ashland and Sioux Geographic Areas (in Montana). Elk numbers in the South Dakota portion of the Custer Gallatin National Forest have also been generally increasing over the past decade, but it is difficult to track specific numbers or trends for the relatively small acreage of Custer Gallatin National Forest in South Dakota (Deisch, S. South Dakota GFP, 2018b. pers. comm.).

Mule deer population estimates for 2018 were above the decadal average (2008-2017) for Montana Fish Wildlife and Parks Regions 3, 5, and 7, which cover the Montana portion of the Custer Gallatin National Forest. White-tailed deer generally occur in lower elevation habitats on the Custer Gallatin, and therefore are not as widely distributed as elk and mule deer. White-tailed deer population estimates for 2018 were above the ten-year average in Montana Fish Wildlife and Parks Regions 5 and 7, but were slightly (about 1 percent) below average in Region 3 in Montana (http://fwp.mt.gov/fishAndWildlife/management/deer). Deer populations are monitored at a broad scale in South Dakota, with no specific estimates for the relatively small acreage of Custer Gallatin National Forest that occurs in that state. South Dakota Game Fish & Parks recognizes the unique habitat of Custer Gallatin lands in northwestern South Dakota and manages a hunting season for mule deer accordingly. White-tailed deer occur in low numbers in South Dakota, and are not specifically managed for hunting, but they are present within the national forest boundary (Deisch, S. South Dakota GFP, 2018b. pers. comm.).

Moose can be difficult to monitor because they are more solitary, and thus more widely dispersed than other large ungulates. However, moose populations in Montana appear to be have been declining since the 1990s based on aerial counts and hunter harvest statistics. As a result, Montana Fish Wildlife and Parks implemented a study to monitor statewide moose population trends and identify possible factors limiting population growth (DeCesare and Newby 2018). Although the study areas do not include portions of the Custer Gallatin Forest, nearby moose populations are stable to increasing in two of the study areas, and potentially declining in another (ibid.). Moose occur at fairly low densities across most of the montane ecosystem (DeCesare et al. 2014) , although their presence in the Pryor Mountains Geographic Area is infrequent. Attempts to survey moose have been sporadic in the montane geographic areas, but aerial surveys in the Hebgen Basin of the Madison, Henrys Lake, and Gallatin Mountains Geographic Area have averaged about 5 moose annually in recent years, compared to counts in the same area that averaged 47 moose during the period from 1965-1971 (Cunningham 2015). Similar declines have been reported from the Beartooth Face, Stillwater and Rosebud drainages of the Absaroka Beartooth Mountains Geographic Area. The pine savanna ecosystem is at the periphery of historic moose range, but they have been sighted with increasing frequency in the Ashland and Sioux Geographic Areas in recent years. Moose appear to be colonizing or recolonizing the Pryor Mountains, Ashland and Sioux Geographic Areas, and may be expanding their range in eastern Montana (DeCesare et al. 2014, Nadeau et al. 2017). Possible explanations for moose population declines include hunter harvest, increased predation, vegetation changes due to large-scale disturbances and natural succession, disease, parasite loads, and climate change (DeCesare et al. 2014). Moose are not known to occur on the Custer Gallatin in South Dakota.

Habitats

Elk, moose and deer are habitat generalists, and although their habitats may frequently overlap, their daily, seasonal and life-cycle needs can vary tremendously within and between species (Ranglack et al. 2017). For example, big game herds in the montane geographic areas are often migratory, with some making long-distance movements between summer and winter range. Conversely, there is no definable winter range for most big game species in the pine savanna geographic areas, where herd distribution does not vary notably by season (DeVore, R. Montana FWP 2017. pers. comm.).

Elk use a wide variety of habitat types, typically wintering in lower elevation, warmer, drier types in the montane geographic areas and moving upslope to spend summers in higher elevation, cooler forest types. Elk often forage in the open grasslands, shrublands, and parklike openings in timbered areas, moving into more densely forested areas to find shelter from weather, extreme temperatures, predators, insects, and human disturbance. Elk are generally grazers, selecting from a wide variety of forbs and grasses, but will also use some woody browse species. In summer, nutritional value of forage is particularly important for elk, especially for females with young under the high nutritional demands associated with lactation. The nutritional value of summer forage typically wanes through late summer and fall as plants progress through the growing season and become more desiccated (Ranglack et al. 2014).

Nutritional value of vegetation can be estimated at the landscape scale using remotely sensed data (such as satellite imagery). Ranglack and others (2014) estimated the nutritional value of forage for elk in southwest Montana, including multiple herds that use portions of the Custer Gallatin Forest. In this study, summer forage value for elk was derived from the Normalized Difference Vegetation Index (NDVI) based on greenness of reflected vegetation images. Using this particular measure, areas of highest summer nutrition values for elk on the Custer Gallatin are generally associated with northerly aspects and higher elevations. Optimal summer nutrition areas for elk are relatively rare on the Custer Gallatin, and generally include wetlands, moist meadows, mesic shrublands, deciduous forest types, and recently burned or transitional forests. Most conifer forest types produce lower nutritional forage values, with the exception of spruce pockets, that occur in wetter areas. Using Normalized Difference Vegetation Index as a measure, tree size class is generally not a good indicator of nutritional value within coniferous forests, until trees reach the larger size classes. Optimal nutrition areas are associated with forested stands in the 15-inch and larger size classes. Canopy cover also influences nutritional value in coniferous stands, with lower values associated with higher (>60 percent) canopy cover.

Elk winter range in the montane ecosystem is characterized by lower elevations, south- and westerly-facing slopes where thermal conditions result in lower snowpack and warmer temperatures, although some elk, particularly bulls, may occasionally winter at higher elevations on wind-swept slopes. In many areas of the Custer Gallatin, elk winter range is a limited extension of primary winter range in the valley bottoms, the majority of which is often on private land. Forage and cover are key attributes of winter range quality, where a typical scenario has elk foraging in open grasslands and seeking shelter in adjacent forest stands. Cook and associates (1998 cited in UDSA and MFWP 2013) found that elk benefit more from forage quality and quantity than from cover in terms of optimal fat metabolism throughout the winter period. They concluded that thermal cover may be important under certain conditions, but its value is relational to other habitat attributes that contribute to the productivity of elk. Forested cover on winter range may have multiple functions including snow interception, thermal regulation, wind buffering and hiding cover to escape predators or human disturbance. Ideal winter range on the Custer Gallatin is likely a mosaic of non-forest and forest habitats that provide optimal juxtaposition of both forage and cover.

Moose are closely associated with boreal forest conditions prominent in northern environments such as Canada and Alaska. They are typically found in cool, moist, mature forest habitat, but some of their preferred forage species such as aspen and other deciduous trees or shrubs, are typically common in recently disturbed areas. Moose also select for riparian habitats, where they feed on willows, forbs, and aquatic vegetation (Foresman 2012).

Unlike other big game species that migrate to lower elevation with lower snow accumulation, moose may remain at higher elevations with greater snow depths, making winter a critical time for moose because forage quality and availability is low, and energetic demands of moving through deep snow while maintaining body heat in cold temperatures are high. Winter habitat for moose is variable across their range, but always includes concentrations of accessible browse. Willow and aspen are among the most palatable browse species to moose, and are often heavily used if available in winter. At higher snow depths, moose will shift away from open browse fields and move into dense stands of conifers where snow depth is ameliorated by canopy cover and tree shading reduces crusting of snow. On the northern winter range located in the Absaroka Beartooth Mountains Geographic Area where the Custer Gallatin abuts the north boundary of Yellowstone National Park, older lodgepole pine forests with subalpine fir understory were found to be heavily used by moose under deep snow conditions. Subalpine fir is a preferred winter browse species for moose in this area (Tyers 2003). Diet analysis in the Hebgen Basin of the Madison, Henrys Lake, and Gallatin Mountains Geographic Area (unpublished data) indicated that for most moose in the Basin, willow makes up a high proportion of the diet. However, conifer needles also make up a substantial portion of some moose diets, even when willow and other browse species appeared readily available. Based on moose pellet samples, in the Hebgen Basin, lodgepole pine comprised a larger portion of moose winter diet than other conifer species.

Moose response to habitat disturbance varies substantially across their range. In many areas, early successional conditions created by fire or logging are beneficial because they result in vigorous regeneration of palatable browse species. However, the relationship of moose to ecological disturbances in parts of the Greater Yellowstone Area appears to be different. In the northern winter range, older lodgepole pine stands are among the most important wintering areas for moose. When subject to disturbance, lodgepole-dominated forests typically regenerate with high density of lodgepole pine seedlings, rather than the more palatable woody shrubs that often appear soon after disturbance in mixed conifer forests. Tyers (2003) found little or no use by moose of lodgepole pine stands less than 100 years old, and highest use of lodgepole pine stands more than 300 years old on the northern winter range of the Custer Gallatin Forest. He also reported a precipitous decline in the moose population following the 1988 fires, which burned a substantial portion of his study area on the northern winter range, and attributed this decline at least in part to the loss of subalpine fir browse in the understory, and loss of canopy cover to intercept snow (ibid.).

Deer, like moose and elk, utilize a wide variety of habitat types making them habitat generalists, but with various habitat conditions sometimes providing very different needs. While mule deer and white-tailed deer often overlap in range, mule deer typically occur at higher elevations, in more rugged terrain. Within the montane ecosystem, mule deer are typically associated with more open habitats, but spend time in the subalpine coniferous forest types as well. In the pine savanna ecosystem, mule deer utilize ponderosa pine forests, sagebrush slopes, woody draws, and badlands. Like other big game species in the montane ecosystem, mule deer typically migrate between higher elevation summer and lower elevation winter ranges with seasonal movements largely driven by the availability of suitable forage. Mule deer are browsers with a highly adaptable diet that varies between seasons and includes woody plat species as well as herbaceous forbs and grasses (Foresman 2012).

Following the onset of winter in the montane ecosystem, populations shift to lower elevations in order to escape greater snow depths. Winter habitats are often characterized by more open grassland or shrub-steppe landscapes. Mule deer will seek out south-facing or wind swept areas to access forage. With the return of spring and associated recession of snow pack, mule deer begin to track the emergence of vegetation and “green up” in their return to higher elevation, more productive summer range (Merkle et al. 2016, Aikens et al. 2017). During the daytime, mule deer seek out areas of more rugged terrain that provide escape routes from predators as well as human disturbance. In the montane ecosystem, escape terrain is associated with steep, rocky areas, whereas badlands, coulees and canyons often provide escape terrain for mule deer in the pine savanna ecosystem.

White-tailed deer generally occur at lower elevations across the Custer Gallatin. In the montane ecosystem, they typically occur near the national forest boundary in riparian areas, and adjacent private lands. White-tailed deer are more ubiquitous in the pine savanna ecosystem, where they are found in riparian areas, woody draws and dense, young ponderosa pine stands, as well as being quite common in adjacent agricultural fields. Cover, including dense ground cover and higher canopy cover, seems to be more important for white-tailed deer than mule deer, and they are often found in close proximity hiding cover. Recent large wildfires within and near the Ashland Geographic Area have notably impacted the availability of hiding cover for white-tailed deer, whereas increased shrub production following the fires has likely benefitted mule deer in the Ashland Geographic Area (DeVore, R. pers. comm. 2017).

In the pine savanna ecosystem, big game herds, including elk, mule deer and white-tailed deer, do not migrate between seasonal ranges (DeVore, R. pers. comm. 2017). Elevation does not vary enough to result in differential snow depths in the pine savanna ecosystem. Winter snow depths on the Ashland and Sioux Geographic Areas are low relative to winter conditions in the montane geographic areas, resulting in better access to forage and easier travel conditions for wintering big game. Therefore, the tree canopy required for thermal cover and snow intercept may be less of a limiting factor for big game in the pine savanna ecosystem than in the montane ecosystem (Canfield et al. 2013).

Cover

Cover is important for big game species for a number of reasons discussed in previous paragraphs. Before beginning the forest plan revision, Forest Service biologists engaged with biologists from Montana Fish Wildlife and Parks to generate a basis to inform and guide forest plan revision efforts as relates to big game species. The result was an interagency overview and set of recommendations for habitat management for big game species (USDA FS and MFWP 2013). As that effort was underway, big game populations were expanding, and in some cases colonizing or recolonizing habitats in the pine savanna ecosystem of eastern Montana and northwestern South Dakota. Since the ecology of increasing big game herds is not well understood for these areas, ongoing collaboration between the states and the Forest Service may result in changing management approaches for big game species over time. The recommendation for providing cover for big game species during spring, summer and fall is to manage coniferous forest within the ecological context of the natural range of variation. Agency biologists concurred that canopy cover is a reasonable surrogate for evaluating coniferous forest cover conditions for big game species at the landscape scale, and that generally coniferous canopy cover of 40 percent or higher provides functional hiding and thermal cover for big game under most conditions. Across the Custer Gallatin, proportion of coniferous canopy cover of at least 40 percent varies by broad potential vegetation type relative to the natural range of variation. In most vegetation types, while proportions of canopy cover class are not all within the natural range, the total proportion at or above 40 percent canopy cover generally is within the natural range of variation (see the terrestrial vegetation section for more detail on canopy cover within forested habitats).

Secure Habitat

Secure habitat is important for reducing big game vulnerability during hunting seasons, and providing animals the opportunity to meet their biological needs throughout the year without being displaced to potentially lower quality habitats. A shared goal for the Custer Gallatin and associated state wildlife management agencies is to provide habitat conditions that support year-round presence of big game species on national forest lands accessible to the public. In some areas of the Custer Gallatin, big game (most notably elk) distribution has become a management concern, as elk are spending significant amounts of time on private lands. The reasons for this changing distribution pattern are varied, and may be due to multiple, and different factors in different areas, including hunting pressure or lack of security on public land, attraction of high-value forage found on agricultural lands, low or no hunting pressure on private lands, and higher densities of natural predators on National Forest System lands compared to private lands. Providing secure habitat on National Forest System lands is considered a potential tool to manage elk distribution (USDA FS and MFWP 2013).

Secure habitat has been measured in many different ways, in many different geographic areas, and at various times. To further complicate matters, different species, different individuals within the same species, and even the same individuals under different circumstances, respond differently to human-caused disturbance factors. A widely accepted measure of secure habitat is distance from roads (Lyon 1983, Hillis et al. 1991, Ranglack et al. 2017). However, there is no universally agreed upon distance at which all individuals of all big game species in all areas under all circumstances will feel secure. Based on research on elk habitat use in Montana (ibid.), the Custer Gallatin has traditionally used a standard distance of one-half mile from a motorized route, including all public and private roads and trails open to administrative, public and private motorized use, to calculate proportions of secure habitat for big game species. Using this measure, roughly 62 percent of the entire Custer Gallatin land base provides secure habitat for big game. By Geographic Area, this figure breaks down to 83 percent secure for the Absaroka Beartooth Mountains Geographic Area, 58 percent secure for the Madison, Henrys Lake, and Gallatin Mountains Geographic Area, 49 percent secure for the Bridger, Bangtail, and Crazy Mountains Geographic Area, 34 percent secure for the Pryor Mountains Geographic Area, 33 percent secure for the Ashland Geographic Area and 29 percent secure for the Sioux Geographic Area.

Key Stressors

- Hunting pressure and other human disturbance can affect big game security and distribution.
- Forage quality and quantity can be affected by livestock grazing, noxious weeds, fire, timber harvest and climate change.
- Loss of forested cover due to wildland fire, insects, disease and timber harvest, can increase big game vulnerability to predation, weather, and hunter harvest.

Environmental Consequences

The analysis in this section is limited to those effects of the proposed alternatives on moose, elk, mule deer, and white-tailed deer. Unless otherwise noted, all subsequent references to big game species in this section refers to these four.

Management Direction under the Current Plans

Under the current plans the existing separate Custer and Gallatin Forest Plans would remain in effect. The Custer Plan identifies elk, mule deer, and white-tailed deer as major interest species. White-tailed deer are classified as habitat indicator species for dog hair ponderosa pine. Winter range forage is considered to be the most significant limiting factor for deer and elk populations within the Custer Plan area. The plan allows restrictions on certain types of activities within big game winter ranges and calving areas where deemed necessary. Livestock grazing and associated range improvements would be implemented in accordance with implementation plans for fish and wildlife management. In certain management areas, timber harvest proposals will be analyzed for wildlife values and potential impacts.

The Gallatin Plan emphasizes forage and cover needs on big game summer and winter range, to be coordinated with other uses. Timber management, prescribed fire, and improved range management practices will be used to improve forage conditions for big game, including the use of prescribed fire to improve winter range condition. The plan contains specific cover retention requirements for big game. Livestock allotments are to be coordinated with wildlife habitat needs. Elk are identified in the Gallatin Plan as an indicator for big game species. Specific Management Area protections for big game include restrictions on certain types of recreation and maintenance, or may allow for improvement of forage quality, general habitat improvements, and prioritization of forage needs.

Effects of the Current Plans

The restrictions set forth in the current plans focus on cover and forage needs of big game with emphasis on winter habitats as the most critical. Cover requirements would be assessed and retention would be prescriptive, rather than striving to manage within the natural range of variation. Temporal and spatial restrictions on the types of projects that can occur within key habitats are intended to minimize the impact of human presence and disturbance on the landscape. Wildlife respond to human presence and noise disturbance in a variety of ways, including movement away from disturbance (flight response), which can result in increased energy demand as well as disruption of other activities, such as foraging or resting (Wisdom et al. 2018).

Some big game species, or individual herds, exhibit migratory behavior, particularly in the montane ecosystem geographic areas. Migration between seasonal habitats represents an important life history strategy that can allow wild ungulates to maximize energy intake by coordinating movements with the emergence of forage (Rolandsen et al. 2017). The current plans do not provide specific habitat connectivity language for big game species outside of the Gallatin Plan's requirement of Management Area 19 to provide for natural elk migration patterns. In addition, the continued use of separate plans with differing direction would not allow for consistent management objectives to be established Forest wide for wide-spread species such and big game.

Management Direction under the Revised Plan Alternatives

As with most wildlife species, the revised plan alternatives use a coarse-filter/fine-filter approach. Coarse-filter components include a comprehensive suite of plan components for Riparian and Terrestrial Vegetation resources, designed to maintain or restore ecological conditions and processes to support diverse plant and animal communities. Fine-filter, forestwide plan components were added for big game species to address general habitat, as well as species-specific needs. Species-specific needs were identified for bison and bighorn sheep, which are addressed separately in the draft environmental impact statement. Fine-filter plan components for big game species in general would be the same under all revised plan alternatives (alternatives B through E). These alternatives address similar issues as existing plans, but with new plan components. Alternatives B through E include a desired condition that wildlife resources contribute to social and economic benefits, including diverse and sustainable opportunities for research, wildlife viewing, photography, hunting and trapping. Wildlife abundance and distribution supports state wildlife harvest and population objectives. A goal is added to highlight the importance of interagency coordination and other partnerships. Guidelines address the retention of forest cover where needed to enhance winter range conditions. Additional guidelines address avoidance of stressing big game with high energy demands; such as on winter range and reproductive areas. Finally, a guideline also addresses the maintenance of secure habitat during the hunting seasonal in order to minimize pressure on big game.

In addition to plan components for big game, the revised plan alternatives highlight the importance of habitat connectivity, which is important for big game species to meet daily, seasonal and long-term life-cycle needs. All revised plan alternatives include desired conditions for landscape patterns that provide habitat connectivity, including structural and functional diversity to support natural movement patterns. Guidelines are added to prevent management actions that would create barriers to movement of big game (and other) species. Finally, alternatives B, C and D adopt key linkage area land allocations with added habitat protection measures in certain areas that may be important for big game movement.

Effects of the Revised Plan Alternatives

Compared with the current plans, the revised plan alternatives, B through E, would provide greater protection for big game seasonal habitats, address habitat connectivity, and standardize big game habitat management forest wide. Plan components would enable big game to contribute to social and economic benefits and support state wildlife harvest and population objectives. Similar to the current plans, winter and reproductive seasonal habitats have been identified as vital for species population health and management actions would be located, timed, or otherwise mitigated to avoid stressing individuals and populations during those seasons. Vegetation management projects would be designed to retain conifer cover on big game winter ranges where needed to provide snow intercept, hiding or thermal cover. Security habitat would be maintained during the hunting season where there is potential for game animals to experience added pressure from hunter use on public lands.

All revised plan alternatives establish desired conditions and goals related to the provision of habitat connectivity of wildlife species with a particular focus on wide ranging ungulates. Alternatives B, C and D also delineate key linkage areas within which restrictions would apply. Key linkage areas were identified in the far north end of the Gallatin Mountain Range and the west side of the Bridger Mountain Range.

Plan components for these areas would minimize construction of permanent facilities and structures, and limit management activities in an effort to concentrate disturbance in space and time to allow for periods of low disturbance to for wide-ranging species. The key linkage areas and associated plan components were primarily designed to promote long-range movements of animals in a northerly or southerly direction across Custer Gallatin lands, potentially connecting landscapes at a scale beyond the national forest boundary. However, land use restrictions in the key linkage areas would restrict permanent habitat alterations, and limit large-scale disturbances in areas that are also important for big game daily and seasonal movements. For example, the west side of the Bridger Range is transitional habitat between summer and winter ranges for elk and mule deer.

Consequences to Big Game from forest Plan Components Associated with Other Resource Programs or Management Activities

Effects from Watershed, Riparian, and Aquatic Management

All revised plan alternatives contain forestwide plan components associated with watershed, aquatic and riparian ecosystems that set the coarse filter strategies that would protect, maintain, or restore water quality and riparian habitat. Specifically, the riparian management zone direction restricts management activities with few exceptions, to allow only those intended to restore, maintain or improve aquatic and riparian habitats. Desired conditions include support for self-sustaining populations of riparian associated plant and animal species. These components would protect or improve habitat conditions in areas important for seasonal forage, notably in the summer and fall seasons when succulent plants and browse species become more important in big game diets. Moose in particular, would benefit from this direction given their year-round reliance upon riparian habitats for cover and forage. In addition to providing important water and food sources, riparian areas are often used as travel corridors by big game (and other) species. Riparian management zone direction under the revised plan alternatives would provide a higher degree of protection for a key habitat used by all big game species than the current plans.

Effects from Terrestrial Vegetation Management

The Custer Gallatin supports a diversity of plant communities distributed in a mosaic across the national forest landscape. Communities such as woodlands, grassland, shrubland, montane and subalpine forests, meadows, and riparian areas have potential to provide important habitat elements for big game. Plan components within the revised plan alternatives address composition, structure, and function of vegetation communities, which provide a coarse filter strategy designed to support disturbance regimes that will maintain and reinforce ecological integrity and biodiversity. Revised plan alternatives include plan components to maintain vegetation within the natural range of variation when possible. All revised plan alternatives contain desired conditions for grassland and shrubland habitats, with native plant communities that are self-sustaining and support biodiversity with few non-native species present. These plan components would provide for a wide diversity of foraging options for big game species.

Forested habitats provide cover and shelter for big game from both environmental conditions and human use such as hunting. Forage can also be found in within forested areas characterized by more open canopies. Revised plan alternatives contain coarse filter components to maintain forested habitats within the natural range of variation, including measurable desired conditions for tree size class and forest density across a range of broad potential vegetation types. To achieve desired conditions in forested habitats, management actions would strive to increase tree size class, with specific guidelines to increase the abundance of trees 15 inches or greater in diameter, which could improve nutritional value of forage within forested areas (Ranglack et al. 2014). Coniferous forest provides hiding cover for big game animals to escape from predators, contributes to thermoregulatory needs, and provides access to winter forage. Desired conditions to maintain forest structure within the natural range of variation for tree density as measured by canopy cover would provide a range of forest cover conditions to meet these needs of big game. The plan also supports a diversity of successional stages that are ecologically resilient and sustainable. Retention of a diverse landscape and mix of structural stages could allow for more effective response to changes in climate or natural disturbance such a fire or disease.

Compared to the existing plans, the revised plan alternatives plan components include greater detail about vegetation conditions, including plant species composition, structure, and function. Such details provide better information for management of grassland, shrubland, and forest environments, which would contribute to biodiversity and ecological integrity of these habitats, and would better serve to meet the forage and cover needs for big game species. Collectively, these coarse filter components would contribute to the suitability of seasonal big game ranges and provide connecting corridors between seasonal habitats over time.

Effects of Land Allocations

The revised plan alternatives differ in their proportion of backcountry area and recommended wilderness area allocations. These allocations can influence the management of big game habitat throughout the Custer Gallatin. The backcountry area allocation is designed to allow for natural processes with little evidence of long-lasting human use. The recommended wilderness area allocation allows natural processes such as wildfire, disease, or natural succession to be the primary forces that shape the environment. These land allocations come with a series of land use restrictions that prohibit certain types of human use. In the he backcountry area, prohibitions include the construction of new roads, new utility corridors, commercial communication sites, and removal of new saleable mineral material. All special uses must be compatible with backcountry character. Recommended wilderness areas are more restrictive in land use allowance than backcountry areas in prohibiting any new recreation developments, new recreation events, new recreational motorized and mechanized means of transport in alternative B and all recreational motorized and mechanized means of transport in alternatives C and D. The restrictions on development and types of human use associated with backcountry areas and recommended wilderness areas may result in the protection and retention of big game habitat. The limitations on land use activities would have the beneficial effect of preventing habitat degradation and displacement of individuals and populations associated with physical and anthropogenic disturbance. The recommended wilderness area allocation could potentially limit the opportunity for implementation of habitat improvement projects within big game seasonal habitats. Encroachment of conifers into aspen, meadows or other habitats can reduce the quality, productivity, and diversity of important forage habitats. The removal of the encroaching species can be an important tool in the maintenance and enhancement of existing habitat conditions for big game species.

The majority of recommended wilderness area and backcountry area allocations across the alternatives tend to fall within higher elevation portions of the Custer Gallatin. Big game tend to utilize higher elevations during the warmer summer seasons and transition to lower evaluations during the winter. Therefore, the land allocations would primarily effect the condition of summer and transitional habitat. This is especially true within the montane ecosystem geographic areas, which include Madison, Henrys Lake, and Gallatin Mountains; Bridger, Bangtails, and Crazy Mountains; and Absaroka Beartooth. Proposed land use destinations within the Ashland and Sioux Geographic Areas would likely encompass year-round seasonal habitats.

The land allocations proposed in alternatives B through E would work in conjunction with existing designated wilderness and inventoried roadless areas to create a series of protected corridors that would maintain habitat connectivity within and between Custer Gallatin administrative units. In the montane ecosystem, Montana Fish Wildlife and Parks personnel have identified the area from Yellowstone National Park to Paradise Valley as a priority big-game winter range and migration corridor (Montana FWP 2018b). This area includes much of the Absaroka Beartooth Mountains Geographic Area, and parts of the Madison, Henrys Lake, and Gallatin Mountains Geographic Area as well. The majority of the Absaroka Beartooth Mountains Geographic Area is within designated wilderness, which provides the highest degree of wildlife habitat protection from land management practices under all alternatives. The revised plan alternatives propose varying combinations of land use allocations for recommended wilderness area and backcountry area within the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas that would support state priorities to improve the habitat quality of western big game winter range and migration corridors (ibid.). Alternative D would add the most acreage of recommended wilderness area, which would extend the land use restrictions well beyond the existing wilderness area. While alternative D with recommended wilderness areas would provide the greatest protection from human disturbance due to land uses, it would also limit the management tools available for habitat enhancement to maintain or restore habitat connectivity if needed.

In the Madison, Henrys Lake, and Gallatin Mountains Geographic Area, additional allocations of recommended wilderness area, backcountry area and key linkage areas, would also contribute to protection of habitat connectivity for wildlife, in a manner that would be complementary to the state priorities for improving big game winter ranges and migration corridors. In the Madison, Henrys Lake, and Gallatin Mountains Geographic Area, Montana Fish Wildlife and Parks personnel have identified the top research priority to improve understanding of the seasonal habitat use and migration corridors for pronghorn antelope in the Madison Valley (Montana FWP 2018b). The Madison Valley sits just west of the Madison, Henrys Lake, and Gallatin Mountains Geographic Area on the Custer Gallatin, and supports one of largest wintering populations of pronghorn in southwest Montana. Evidence suggests that a substantial portion of this population migrates to different summer range, with some perhaps moving into and across the southern portion of the Custer Gallatin, and possibly into Yellowstone National Park (ibid.). This hypothesis raises questions about the importance of the area around Hebgen Lake as a possible connection for pronghorns between the Madison Valley and Yellowstone Park. All alternatives include plan components for coordination with state wildlife management agencies, and the revised plan alternatives contain specific goals to work across boundaries to promote wildlife habitat connectivity, improve knowledge bases, and raise public awareness that would support this top Montana research priority for wildlife movement.

Effects from Permitted Livestock Grazing

Direct interaction between livestock and big game are likely to occur especially within the eastern geographic areas (Ashland and Sioux) where the majority of permitted livestock use occurs. Effects of livestock grazing on big game species can include direct competition for resources and degradation of habitat conditions. Grazing can influence vegetation communities through reduced productivity, changing plant composition, and herbaceous structure (Boyd et al. 2014). Coe et al. (2001) suggests competition for resources has the potential to occur between cattle and elk to a higher degree than between mule deer and cattle. Elk demonstrated a higher degree of displacement and avoidance from cattle compared to mule deer this is likely due to resource partitioning and associated spatial displacement (Coe et al. 2001, Stewart et al. 2002). It is important to note that temporal niche partitioning of resources has the potential to break down under changing climatic and environmental conditions which could result in more direct competition for resources between species (Herfindal et al. 2017). This highlights the importance of maintaining a balance and diversity of forage species on the landscape to benefit big game as they transition between seasonal ranges. Increased vegetative vigor and production could retain a greater proportion of digestible biomass for big game species to utilize. Indirect effects include those associated with grazing infrastructure, including mortalities associated with fence entanglements.

Under the revised plan alternatives, all new or revised allotment management plans shall design grazing practices (such as stocking levels, duration, timing), and physical structures (such as off-site water developments or hardened stream crossings) to avoid, minimize, or mitigate adverse livestock related effects in order to maintain or improve resiliency of riparian and upland ecosystems, and associated flora and fauna. The revised plan alternatives contain a desired condition that grazing allotments supply livestock forage and contribute to local ranching operations, while staying within or moving toward desired ecological conditions. A standard would require new or revised allotment management plans to design grazing practices to maintain or improve resiliency of riparian and upland ecosystems. Grazing-specific guidelines contain measures to maintain or improve riparian habitat, including specific, quantifiable forage utilization measures within riparian areas. Infrastructure such as fences and water developments should be designed and located to prevent barriers and reduce the probability for injury or mortality to wildlife.

Effects from Minerals Management

Industrial development has the potential to greatly impact big game populations through the removal and fragmentation of suitable habitats and the avoidance of development on the landscape. Behavioral changes including avoidance and displacement can be long lasting with limited evidence of acclimation by individuals or herds (Sawyer et al. 2017). In addition, energy development could influence harvest efficiency and probability for sportsman by increasing access potential or displacement of individuals (Dorning et al. 2017). Under all revised plan alternatives, mineral and energy development activities include provisions to reclaim disturbed areas and minimize adverse effects to riparian resources.

Effects from Infrastructure and Recreation Management

The installation, maintenance, and use of recreation facilities including trails has the potential to affect big game through removal or fragmentation of habitat and displacement through avoidance of human use. The revised plan alternatives include several forest wide components that address the addition of new, and maintenance of existing, recreation facilities such as trails, campgrounds, picnic areas, etc. The revised plan alternatives include desired conditions for recreation facilities to have minimal impacts on ecological integrity and diversity, as well as overall compatibility with natural resources. Plan components include requirements for infrastructure such as roads, trails and other facilities to minimize impacts to riparian habitats and limit disturbance to associated wildlife species. There is an objective to remove or relocate some existing recreation facilities out of riparian areas. New developed sites would be designed to replace existing dispersed sites that are degrading riparian resources. Components address potential impacts from the location of facilities and the introduction of invasive species through ground disturbing activities.

Cumulative Effects

The framework for big game population management is determined by the applicable state wildlife management agency, Montana Fish Wildlife and Parks and South Dakota Game and Fish. The state agencies utilize a variety of data sources to gather together population estimates, trends, and habitat condition across different seasonal ranges and big game populations. This information is used in the establishment of harvest limits and hunting seasons. The State of Montana recently instituted an action plan designed to improve the quality of big game winter arranges and migration corridors (Montana FWP 2018b).

Given the wide distribution of big game species across the Custer Gallatin and throughout the region, management of these species involves multiple agencies and plans. Neighboring forests such as the Beaverhead-Deerlodge, Helena-Lewis and Clark, Caribou-Targhee, and Shoshone National Forests have goals for wildlife habitat that are compatible with those outlined in the Custer Gallatin revised plan alternatives. The Beaverhead-Deerlodge seeks to provide a mosaic of species and age classes that provide cover and forage for wildlife along with secure areas and seasonal habitat connectivity for ungulates. The Helena-Lewis and Clark is proposing ungulate winter range be relatively free of human disturbance during seasonally active time periods. The Shoshone applies seasonal restriction on motorized use of travelways within big game crucial winter ranges. Other federal land management agencies such as the Bureau of Land Management Miles City Field Office requires that surface disturbing and disruptive activities have design features that maintain the functionality of crucial winter range habitat. This does not represent a complete list of management requirements but serves to highlight the compatible nature of direction focusing on many of the same issues addressed in the Custer Gallatin proposed plan components and alternatives.

Conclusion

The big game species discussed in this section occur throughout much of the Custer Gallatin national forest. These species are wide-ranging and as such require a diversity of habitat types distributed across the landscape. All revised plan alternatives contain plan components that are designed to develop or maintain a diversity within vegetative communities and age-class structure. The retention and maintenance of suitable hiding and thermal cover and the diversity of vegetation types and structure could benefit forage quality and abundance. Greater level of protections and more specific language is contained within the revised plan alternatives, than the current plans. The revised plan alternatives better address emerging issues and more thoroughly address issues and provide protections for all seasonal habitat needs compared to the existing plans.

Each alternative differs in the land allocations within each of the geographic areas. Alternative D provides the greatest amount of proposed recommended wilderness area acreage and likely represents the greatest level of management restrictions. However, this would include a reduced opportunity for habitat enhancement or maintenance projects within crucial wildlife habitats. Alternatives B and C represent intermediate levels of restriction relative to the other alternatives and include both recommended wilderness area and backcountry area allocations within big game habitats. Alternative E proposes no recommended wilderness area, but proposes two backcountry areas. Alternatives B, C and D also delineate a key linkage area designed to minimize impediments to the movement of wide-ranging species such as big game. The plan components for managing permitted livestock grazing, vegetation management, mineral and energy development, administrative and recreational facilities would help maintain or enhance big game habitat conditions and minimize human disturbance within critical habitat areas. The revised plan alternatives would provide better protection for, and potential improvement of, big game populations, seasonal habitat condition, and habitat connectivity than the current plans.

Bison (*Bison bison*)

The American bison is an iconic symbol of Yellowstone National Park, and was recently officially designated as the United States' national mammal (The National Academies of Sciences 2017). The Custer Gallatin is unique within the National Forest System in that it borders Yellowstone Park on the north and west sides, where bison naturally tend to migrate to lower elevation habitats on National Forest System lands when winter snows become too deep in the Park. The Yellowstone bison population is unique in that it is genetically pure due to isolation from domestic bovines (such as cattle), and it contains thousands of individuals that exhibit wild behavior, roaming relatively free over large landscapes (White et al. 2015). As such, this bison population is of great social, economic, and spiritual importance to local, regional, national, international and tribal visitors to the Greater Yellowstone Area, including the Custer Gallatin National Forest. Bison have a key ecological role in the Greater Yellowstone Ecosystem, and are managed largely under the auspices of an Interagency Bison Management Plan, developed in partnership between Yellowstone National Park, the state of Montana, USDA Forest Service and Animal and Plant Health Inspection Service (USDI NPS 2000).

Enabling legislation for State and Federal agencies mandates coordinated conservation of wildlife and habitat. Consequently, responsibility for management of Yellowstone bison and their habitat is jointly held by State and Federal agencies. Inside Yellowstone National Park, the secretary of interior has exclusive jurisdiction to manage Yellowstone National Park's resources, including bison and their habitats. Outside Yellowstone National Park, the primary role of the Custer Gallatin National Forest is management of habitat, whereas state agencies (Montana Fish Wildlife and Parks, Montana Department of Livestock) have the lead role in managing bison populations.

Bison are the largest terrestrial mammal in North America, although considerable size variation occurs between subspecies, as well as sex and age cohorts. Historically, two subspecies of bison occurred in North America; the woods (or mountain) bison (*B. b. athabascae*) which is the larger of the two, and the plains bison (*B. b. bison*), which is slightly smaller, although still quite massive (Adams and Dood 2011). Yellowstone bison are descended from the plains bison (White et al. 2015). The original remnant herd that survived in Yellowstone National Park in the late 1800s consisted of a small number of individuals, and the herd was later augmented with bison from other areas. As suggested by their name, plains bison are adapted to short-grass prairie habitats found in the Great Plains. They feed primarily on grasses, but will also eat forbs and woody browse species when grasses are limited (Meagher 1973).

Historically, bison were present throughout most of North America, numbering in the millions (Adams and Dood 2011). Currently they are found in isolated units throughout their historic range (http://exporer.natureserve.org). Pre-European settlement of the American west, Yellowstone bison occupied approximately 20,000 km^2 (7,722 mi^2) in the northern Greater Yellowstone Area, whereas they presently occur primarily within an area of about 3,175 km^2 (1,225 mi^2), or roughly 16 percent of their historic range (USDI FWS 2015d). Bison population size is strongly correlated with age and sex structure of the herd, as well as habitat quality and forage availability. Herd sizes are generally smaller in mountainous or forested habitat than in large open prairie habitats (Adams and Dood 2011).

As mammals of large body size, Yellowstone bison are relatively long-lived, with the oldest individuals aged at over 20 years (White et al. 2015). Survival rates are high for prime age adults at roughly 95 percent. Mortality rates are highest for calves and older bison. Breeding occurs during summer and early fall, and most bison calves are born in April or May, although there is evidence that calving season may be influenced by forage availability; such as earlier after a mild winter or later after a particularly hard winter. Calves born later in the season may have a lower survival rate. Availability of vegetative cover may influence whether cow bison give birth in isolation, or stay closer to the herd. Typically, cow bison have only one calf each year, although on rare occasions, twins may be produced (Adams and Dood 2011).

Partly because of their size, but also due to behavioral characteristics, bison have a key ecological role, and are considered a “keystone species” in prairie/grassland ecosystems. They provide food for a variety of large predators and a whole suite of scavengers. They influence vegetation composition and structure through grazing, hoof action, and seed dispersal. They contribute to nutrient cycling through deposition of urine and feces, as well as decomposition of bison carcasses. They create wallows by rolling in the dirt to remove parasites and shedding fur, add dust for thermal regulation, and promote pheromone exchange during the breeding season (or rut). Wallows are depressions in compacted soil, which collect rainwater and runoff, creating microsites that are capable of producing lush vegetation that may otherwise be limited in a short-grass prairie environment. These traits give bison considerable influence on the plant and animal communities around them (Adams and Dood 2011).

Yellowstone bison can carry a bacterium-caused disease called brucellosis, which was originally transmitted to wild bison and elk in the Greater Yellowstone Area by domestic cattle in the early 1900s. The only remaining source of brucellosis left in the United States is in wild bison and elk in the Greater Yellowstone Area (Aune et al. 2011). Brucellosis causes pregnant ungulates to abort, with potential impacts at the population level. The disease has since been eradicated from domestic livestock for the most part, except for isolated incidents in recent years. Just as the disease can be transmitted from domestic livestock to wild animals, it can also be transmitted from wildlife to domestic livestock. However, there has never been a confirmed case of brucellosis transmission from bison to cattle in the wild, and to date, all known cases of brucellosis transmission from wild ungulates to domestic livestock have come from infected elk (Rhyan et al. 2013, White et al. 2015, Kamath et al. 2016, The National Academies of Sciences 2017). While there are no known cases of brucellosis transmission form bison to cattle in the wild, because such transmission is possible, the state of Montana designated bison management zones, or areas where bison presence would be tolerated (Montana FWP 2015b). These zones fall primarily on National Forest System lands within the Custer Gallatin National Forest.

Analysis Area

Bison presence is currently limited to relatively small areas on the Custer Gallatin, primarily located within state-identified bison management zones west of Yellowstone Park in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area and north of the park in the Madison, Henrys Lake, and Gallatin Mountains and Absaroka Beartooth Mountains Geographic Areas. There is suitable habitat for bison outside these management zones, and bison occasionally wander, but not far, outside the zones. Bison are native to the Custer Gallatin, and their presence in suitable habitat on National Forest System lands is a desired condition. Therefore, the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas were used as the spatial bounds for effects analysis. Given the current social constraints on bison tolerance in rural, residential and agricultural lands in Montana, it is unlikely bison would successfully migrate beyond these geographic areas to other areas of the Custer Gallatin during the life of the forest plan.

Affected Environment (Existing Conditions)

Bison were historically present across the Custer Gallatin Forest, with highest densities in the Absaroka Beartooth Mountains, Ashland, and Sioux Geographic Areas. Due to a combination of factors including hunting, poaching, drought, disease transmission and competition from domestic livestock, bison were extirpated from the Custer Gallatin National Forest by the turn of the 20^{th} century. However, a small, remnant herd remained within the confines of Yellowstone National Park. The Yellowstone bison population was heavily managed and artificially maintained within Yellowstone National Park boundaries until the late 1960s, when natural regulation through predation, weather, and forage availability was allowed a more prominent role. The population quickly responded with increasing bison numbers, resulting in large-scale bison migration outside the Park during winters in the late 1980s (Adams and Dood 2011, White et al. 2015). This fairly recent development initiated the return of bison to seasonal use of habitat within the Custer Gallatin National Forest.

Bison are migratory, and capable of long-distance movements between seasonal ranges. Meagher (1973) reported that Yellowstone bison winter in lower elevation valleys, moving in spring to summer ranges at higher elevations, and then reversing the migration pattern again in fall. Following this pattern, Yellowstone bison spend most of the year inside Yellowstone National Park, migrating to lower elevation winter range, including some areas on the Custer Gallatin National Forest, when snow levels restrict access to forage at higher elevations.

The Yellowstone bison population consists of two genetically distinguishable groups, the northern and central herds, which spend the majority of their time in side Yellowstone National Park. However, during winter, some bison from the northern herd migrate onto the Custer Gallatin National Forest in the Gardiner Basin area north of the park boundary, while some bison from the central herd migrate west of the park boundary and onto the Custer Gallatin in the Hebgen Basin area near the town of West Yellowstone, Montana. In Montana, the Department of Livestock manages livestock disease control programs. Because bison leaving Yellowstone Park can transmit brucellosis to cattle in Montana, the state veterinarian has the authority and discretion to remove bison that pose a threat to livestock (White et al. 2015). Removal of bison for such purposes can influence the numbers and distribution of bison on the Custer Gallatin. In December 2015, Montana Governor Steve Bullock signed a decision notice that expanded management zones for bison. This decision was based on new information and changed conditions including new scientific information indicating negligible risk of transmission of brucellosis from bull bison to cattle, and closure of a number of livestock grazing allotments on the Custer Gallatin Forest (Montana FWP 2015b). The expansion nearly tripled the size of the western management zone, and increased the northern management zone to roughly eight times its previous size. As a result, bison may persist year-round in these parts of the Custer Gallatin, without being hazed back into Yellowstone Park (figure 40 provides the location of bison management zones).

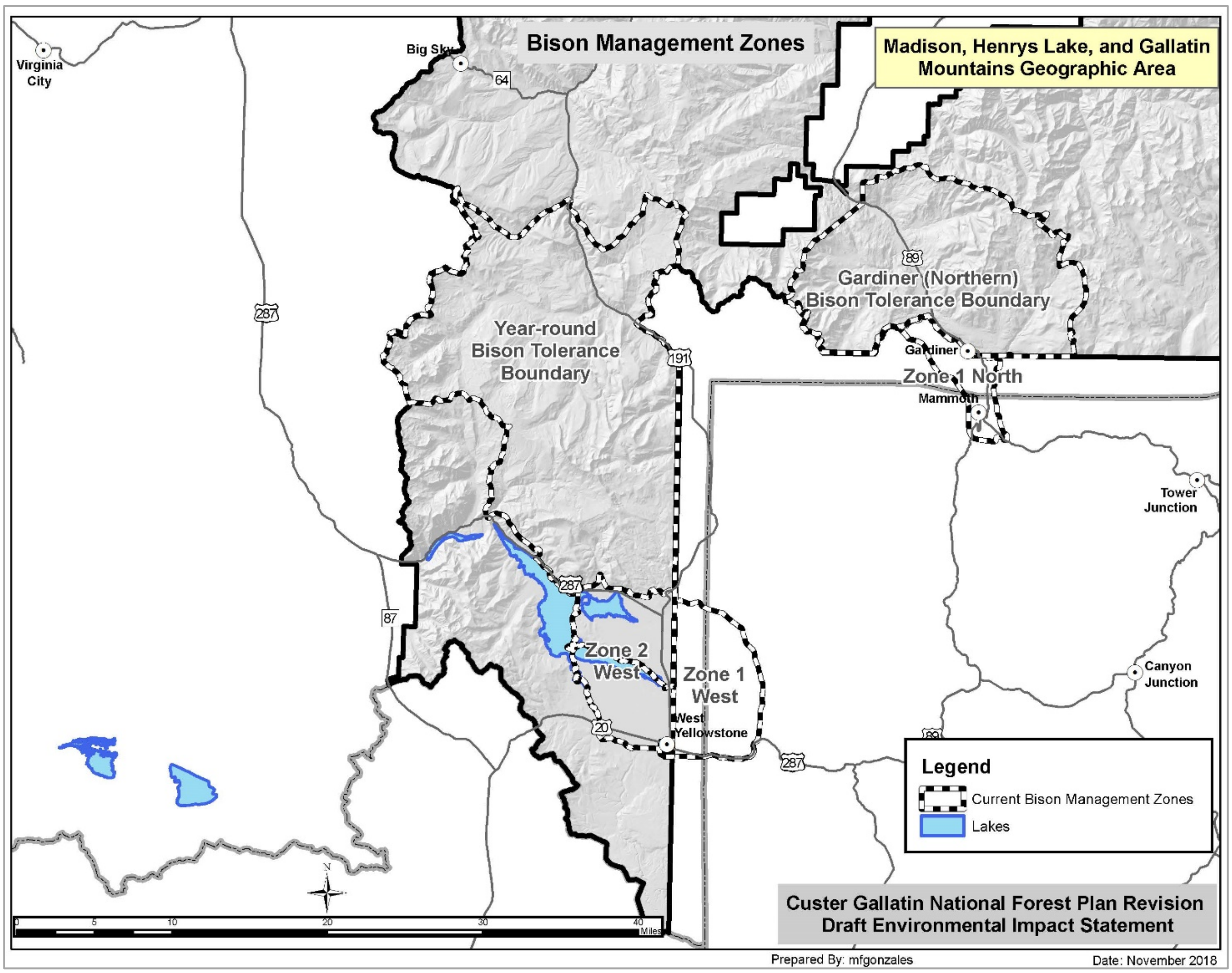

Figure 40. Bison management zones

Cattle are permitted on Forest Service grazing allotments within the bison management zones, although the number of cattle allotments in areas where bison migrate onto the Custer Gallatin National Forest have been reduced in recent years through willing participation with grazing permittees, as well as partnerships with state and federal agencies along with contributions from private organizations. Currently, there are no active cattle allotments inside the western management zones. However, just outside the western management zones, two active cattle allotments running cow and calf pairs and one vacant allotment previously ran yearling cattle. Cattle could be re-stocked on the vacant allotment at some time in the future. In addition, there are six active grazing allotments for horses inside the western management zones. Horses have not been identified as a potential threat for disease transmission to or from wild bison. There are two active cattle allotments running cow and calf pairs, and three vacant allotments that previously ran cow and calf pairs, inside the northern bison management zone. In addition, there are three active livestock grazing allotments outside but near the northern bison management zone. These allotments currently run cow and calf pairs, yearling cattle, and horses. There have been no incidents of bison and cattle comingling on these allotments due to spatial and temporal separation.

Since the Interagency Bison Management Plan was first signed in 2000, a number of livestock allotments have been permanently closed within and near the bison management zones on the Custer Gallatin. Most of the closed allotments ran cattle, including six allotments inside and one allotment outside the western management zones, plus two allotments inside and one allotment outside the northern management zone. Cattle or other classes of livestock would not be re-stocked on these allotments without appropriate environmental analysis. Table 63 and table 64 show the history of livestock allotments relative to bison management zones on the Custer Gallatin.

Table 63. Active or vacant domestic livestock allotments within or nearby Bison Management Zones

Allotment Name	Location	Status	Class of Livestock	Permitted Season
Moose	Western Zone 2	Active	Horses	7/1–9/1
Grayling Creek	Western Zone 2	Active	Horses	7/1–10/31
Sage Creek	Western Yearlong	Active	Horses	6/15–10/15
North Cinnamon	Western Yearlong	Active	Horses	7/1–9/18
South Cinnamon	Western Yearlong	Active	Horses	6/20–10/20
Taylor Fork	Western Yearlong	Active	Horses	6/15–10/15
Watkins Creek	Outside Western Zone	Active	Cow/calf pairs	7/1–9/30
South Fork	Outside Western Zone	Active	Cow/calf pairs	7/1–9/30
Sheep Mile	Outside Western Zone	Vacant	Yearlings	Not applicable
Slip and Slide	Northern Zone	Active	Cow/calf pairs	6/16–10/15
Green Lake	Northern Zone	Active	Cow/calf pairs	6/16–10/15
Cottonwood	Northern Zone	Vacant	Cow/calf pairs	Not applicable
Lion Creek	Northern Zone	Vacant	Cow/calf pairs	Not applicable
Mill Creek & Section 22	Northern Zone	Vacant	Cow/calf pairs	Not applicable
Tom Miner & Ramshorn	Outside Northern Zone	Active	Cow/calf pairs	7/1–10/15
Horse Creek & Reeder Creek	Outside Northern Zone	Active	Cow/calf pairs, yearlings, horses	7/1–9/30
Wigwam	Outside Northern Zone	Active	Cow/calf pairs	6/16–9/30

Table 64. Closed domestic livestock allotments within or near Bison Management Zones

Allotment Name	Location	Previous Livestock Class	Year Closed
Horse Butte	Western Zone 2	Cow/calf pairs	2009
Duck Creek	Western Zone 2	Cow/calf pairs	2008
Dry Gulch	Western Zone 2	Cow/calf pairs	2008
Wapiti	Western Yearlong	Cow/calf pairs	2015
Cache-Eldridge	Western Yearlong	Cow/calf pairs	2015
University	Western Yearlong	Sheep	2008
Red Canyon	Western Yearlong	Cow/calf pairs	2015
Basin	Outside Western Zone	Cow/calf pairs	2015 – West Unit1
Sulphur Springs	Outside Western Zone	Horses	2015
Lionhead	Outside Western Zone	Sheep	2008
Two Top	Outside Western Zone	Sheep	2008
Park	Northern Zone	Cow/calf pairs	2007
Sentinel Butte	Northern Zone	Cow/calf pairs	2007
Canyon	Outside Northern Zone	Cow/calf pairs	2007

Note: East Unit added to Basin Admin Site for periodic government stock use (horse/mule)

Wallen (2012; cited in Montana FWP and DOL 2013) mapped potential habitat for bison in Yellowstone Park as well as the bison management zones on the Custer Gallatin. Using similar parameters (Wallen, R. Yellowstone National Park, 2016. pers. comm.), a query of existing vegetation (using Northern Region VMap data) was used to estimate potential bison habitat for the entire Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas. Potential bison habitat includes grass, forb and shrub fields as general range, and open (less than 25 percent canopy cover) forest areas as spring range. Roughly 11 percent of the Absaroka Beartooth Mountains GA provides potential habitat for bison, along with about 15 percent of the Madison, Henrys Lake, and Gallatin Mountains Geographic Area. This relatively simple GIS exercise estimated over 223,000 acres of general bison habitat, plus roughly 69,000 acres of spring range, for a total of approximately 292,000 acres of potential bison habitat on the Custer Gallatin in the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas combined.

Bison first began leaving Yellowstone Park to winter on the Custer Gallatin in the 1980s (Meagher et al. 2002). Since then, bison numbers using the Custer Gallatin have been rising. According to the most current data, over 400 bison were observed in the northern management zone in spring of 2018 (Interagency Bison Management Plan 2018) and about 300 bison observed in the western management zone in the spring of 2017 (Interagency Bison Management Plan 2017). Bison that leave Yellowstone Park and move onto the national forest are hunted by tribal members as well as the general public. Hunter harvest, which largely only occurs on National Forest System lands, has also been increasing over the years, from a low of one bison harvested in 2009 to a high of 468 taken in 2016-2017. Bison harvest on the Custer Gallatin went down for the first time in 2017-2018 to 375 (Geremia et al. 2018).

Vegetation baseline data gathered from National Forest System lands in the Gardiner Basin was used to calculate forage availability for general bison habitat in the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas. Using a fairly conservative allocation for bison given the forage needs for other wild ungulates and domestic livestock, it is estimated that the Absaroka

Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas have a combined grazing capacity to support roughly 1,177 bison year round, or perhaps twice that many bison for only seasonal (winter or spring) use. Forage availability could be affected by changing climates; fire frequency, severity and size; and competition for forage by wild and domestic ungulates.

Key Stressors

Bison are large animals that compete directly with humans and domestic livestock for space and resources. As such, the primary limiting factor is social tolerance for bison on the landscape. Within the Greater Yellowstone Area, large portions of historic bison range are now occupied by agricultural, residential and recreational developments. Social and political concerns over bison expanding outside the park include human safety, property damage, competition with livestock and big game species for forage, and disease transmission between bison and cattle (White et al. 2015).

It has long been argued that Yellowstone bison pose a serious threat of disease transmission to cattle. However, there has never been a confirmed case of brucellosis transmission from bison to cattle in the wild, and to date, all known cases of brucellosis transmission from wild ungulates to domestic livestock have come from infected elk (White et al. 2015).

Climate can influence bison survival rates, as harsher winters with deeper snow, and longer freezing periods affecting forage availability and body condition, which can increase winter mortality rates. Climate may also impact reproductive rates, with lower birth rates or reduced calf survival associated with severe weather conditions the previous winter (Adams and Dood 2011).

Population density can affect bison survival rates, particularly when combined with climate effects resulting in more severe winters. Geremia and others (2009 cited in Adams and Dood 2011) found that female bison survival decreased significantly in the central Yellowstone herd when the herd size exceeded 2,000 animals, an effect that was notably intensified during winters with deeper snowpack.

Environmental Consequences

Management Direction under the Current Plans

There is no existing direction in either the Gallatin or Custer Plan specific to bison or bison habitat management, but bison presence has been limited to seasonal (winter or spring) use on small spatial areas on the Gallatin, and management has occurred in a cooperative manner under the Interagency Bison Management Plan.

Effects of the Current Plans

Under the existing plans, bison would continue to be treated as a native species whose presence is accepted and desirable on the Custer Gallatin. Specific actions would continue to be driven by the recommendations and priorities set forth in the Interagency Bison Management Plan. Even though the existing plans have no specific direction for bison management, positive steps have been taken under these plans, particularly in the reduction of livestock allotments within the bison management areas. Some closure of livestock grazing allotments has been consistent with existing plan direction for grizzly bear habitat management as well, but some closures have been with a specific focus on reducing potential conflicts between bison and livestock. Under the existing plans, bison habitat management would likely be focused within bison management zones, which would support continued persistence of the species on the Custer Gallatin, but would be less pro-active than the revised plan alternatives.

Management Direction under the Revised Plan Alternatives

The revised plan alternatives acknowledge the presence of bison on the Custer Gallatin, recognizing the key ecological role of this native species with desired condition statements for bison having access to forage, security and movement corridors to facilitate distribution of the species to suitable habitats on the Custer Gallatin, and that habitat accommodates bison migration out of Yellowstone National Park in winter, as well as supporting year-round bison presence on the Custer Gallatin. All revised plan alternatives include desired conditions for adequate connecting corridors between suitable habitats to facilitate bison on the landscape with sufficient distribution to be resilient to stressors, adaptable to changing conditions and contributing to stable or increasing genetic diversity. Finally, revised plan alternatives desired condition acknowledges the need to provide educational materials to help Forest users understand wild bison behavior and act accordingly to avoid conflicts. Alternative D goes a step further than the other alternatives in that it contains a desired condition for bison presence on the Custer Gallatin National Forest year-round with sufficient numbers and distribution to provide a self-sustaining bison population.

The revised plan alternatives recognize the importance of ongoing interagency efforts focused on bison management, with a goal statement for Forest Service engagement with State, Federal, Tribal and other willing partners to expand the science of bison ecology, foster awareness of the important biological, ecological and cultural roles of bison on the landscape, and cooperatively develop adaptive strategies to manage bison and their habitats to facilitate natural movement patterns of bison.

Alternatives B, C and D contain objectives to undertake bison improvement projects within, or for the purpose of creating or connecting, suitable habitat for bison on the Custer Gallatin. Alternative E has no such objective.

Alternatives B, C and D include a guideline that vegetation treatment and management actions taken to resolve bison-livestock conflicts should favor bison within the bison management zones on the Custer Gallatin, whereas alternative E contains a guideline that such actions should favor livestock within the bison management zones.

All revised plan alternatives include guidelines to facilitate the progressive expansion of bison management zones over time.

Alternatives B, C and E state that, except where needed to achieve interagency bison population and distribution objectives, management direction should not limit bison expansion into unoccupied suitable habitat on the Custer Gallatin.

Alternative D states that management actions should not impede bison expansion into unoccupied suitable habitat.

Effects of the Revised Plan Alternatives

Currently, bison management on the Custer Gallatin is conducted through cooperation with state and federal agencies, as well as Tribes, under the adaptive management approach of the Interagency Bison Management Plan. Under this strategy, the Yellowstone bison population has been on an upward trend, even with the use of hunting and culling operations to manage population levels. Consequently, bison numbers on the Custer Gallatin have increased as well, as bison numbers exceed the carrying capacity of winter range in Yellowstone Park. Although existing plans have no specific direction for bison management, the Custer Gallatin has taken positive actions, such as closure of livestock grazing allotments, to make conditions on the Custer Gallatin more conducive to bison presence year round over a larger area. All revised plan alternatives incorporate plan components acknowledging that bison are a native wildlife species, whose presence and long-term persistence on the Custer Gallatin is desired. The revised plan alternatives address bison needs such as access to forage, security and movement corridors to facilitate distribution of the species in suitable habitats on the Custer Gallatin, and specifically state that habitat on the Custer Gallatin accommodates bison migrating out of Yellowstone Park in winter, as well as supporting year-round presence on the Custer Gallatin National Forest.

Alternative D goes furthest toward accommodating bison spatial and temporal expansion on the Custer Gallatin with a desired condition for bison presence year-round with sufficient numbers and adequate distribution to maintain a self-sustaining population on the Custer Gallatin. This alternative would fully support proactive measures within and outside the bison management zones to maintain or improve existing habitat conditions such that bison can freely move between suitable habitats within the management zones, but also so that habitat conditions outside the existing zones are suitable for increases in bison numbers, distribution, and time spent on the Custer Gallatin. This desired condition may be difficult to achieve, since only portions of the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas are within what is thought to be the pre-European settlement distribution of Yellowstone bison (White et al. 2015). Social bonds among bison are very strong, as are the animals’ instincts to aggregate. Bison are constantly on the move, and their movements are often initiated to maintain social bonds. Therefore, the potential for wide-range bison expansion on the Custer Gallatin will likely be restrained by the bison’s desire to aggregate and maintain traditional use patterns (Meagher, M. Ret. Yellowstone National Park, 2017. pers. comm.).

The revised plan alternatives would continue the commitment to cooperate with state and federal agencies, Tribal members, and other willing partners with a goal to expand the science of bison ecology, foster awareness of the important biological, ecological and cultural roles of bison on the landscape, and cooperatively develop adaptive strategies to manage bison and their habitats to facilitate natural movement of bison into and between suitable habitats. This goal would encourage new research, monitoring and educational efforts to increase the existing knowledge base, as well as to disseminate information about bison biology, ecology and habitat management to a broad base of Forest users.

Under Alternatives B, C and D, vegetation treatment projects within bison management zones should result in favorable conditions for bison, and management actions taken to resolve bison-livestock conflicts within bison management zones should favor bison over livestock. Examples of beneficial vegetation treatments include timber harvest or prescribed fire that remove conifer encroachment from otherwise suitable winter range, increase forage production, or reduce tree density to facilitate bison movement between suitable foraging areas. Examples of management actions favoring bison over livestock could include closure of livestock allotments, altered livestock turn-on dates, change in class of livestock from cows and calves to bulls, steers, horses, or mules that do not have the same brucellosis concerns, or relocating livestock to other areas where there is lower risk of conflict with bison. These proactive measures would create conditions that are more conducive to bison expansion into currently unoccupied, but suitable habitats within the bison management zones. Objectives for bison habitat improvement projects could result in better habitat connectivity for bison to move between suitable habitats, improved forage conditions within suitable habitats, or both. Alternative D has the highest objective for bison habitat improvement projects.

Alternative E would improve upon the existing condition by incorporating specific plan components for bison, including desired conditions for bison presence, distribution and long-term persistence on the Custer Gallatin. However, unlike the other revised plan alternatives, alternative E gives more emphasis to livestock operations within bison management zones and beyond. Alternative E has no objectives to implement bison habitat improvement projects on the Custer Gallatin. Vegetation treatment projects would be designed with livestock needs in mind, which may also benefit bison but not necessarily so. Should bison presence within or outside the management zones be deemed a threat to livestock on National Forest System or private lands, the bison could be removed through hazing, hunting, capture or culling, rather than altering the livestock operations. Alternative E would therefore support long-term bison persistence on the Custer Gallatin, but at a reduced spatial and temporal scale than the other revised plan alternatives.

Bison leave Yellowstone Park and move onto the Custer Gallatin Forest when winter conditions become too extreme to support the entire bison population in the park. Climate influences these migration patterns (Adams and Dood 2011). There is strong scientific evidence that climate is changing. Climate projections for the Greater Yellowstone Area predict increasing temperatures and precipitation in coming years (Halofsky et al. 2018a). Warming temperatures could mean milder winters in Yellowstone Park, with reduced pressure for bison to move to lower elevations (and onto the national forest). On the other hand, warmer winter temperatures could result in more freeze-thaw events, creating more ice, or denser crust on snowpack, making it more difficult for bison to expose forage, causing animals to move to lower elevations. Climate projections also indicate more extreme seasonal events, which could result in periodic episodes of harsh winters with deeper snow and colder temperatures (Halofsky et al. 2018b), which may also pressure bison to move out of Yellowstone Park onto the Custer Gallatin. All revised plan alternatives promote bison expansion into currently unoccupied but suitable habitat on the Custer Gallatin, which would accommodate regular or periodic migrations of bison out of Yellowstone Park.

Consequences to Bison from Forest Plan Components Associated with Other Resource Programs or Management Activities

Effects from Water, Aquatic, and Riparian Management

As with most wildlife, access to water is crucial for bison. Sedges are primary forage species for bison during all seasons. Wetlands, creek banks and pond edges support dense production of sedges and other important forage species for bison (Meagher 1973). All revised plan alternatives contain a suite of forestwide plan components that provide more detail and clarity regarding the conditions and management of water quality and riparian habitats, which would contribute to the ecological integrity and resilience of watersheds on the Custer Gallatin to a greater degree than the current plans. Compared to the existing plans, all revised plan alternatives include more rigorous restrictions on what types of management actions may or may not occur within riparian management zones, which would benefit bison through maintenance, improvement or restoration of wetlands, riparian areas, and water sources that provide crucial resources for bison.

Effects from Terrestrial Vegetation Management

The Custer Gallatin supports a diversity of plant communities in a mosaic of woodland, shrubland and grasslands, montane to subalpine forests, open parklands and riparian areas, all of which may provide different habitat elements for bison. Broadly speaking, bison use open meadows and parklands for foraging, woodlands and forested areas for shelter, and riparian habitats for forage, cover and access to water (Meagher 1973). All revised plan alternatives include plan components to maintain vegetation within the natural range of variation to the extent possible. To that end the revised plan alternatives contain plan components that address composition, structure, and function of vegetation communities, which provide a coarse filter strategy designed to support disturbance regimes that will maintain and reinforce ecological integrity and biodiversity. These coarse filter components provide the basis to maintain or restore habitat conditions to which Yellowstone bison have adapted over time. A detailed analysis of vegetation conditions on the Custer Gallatin and anticipated effects of plan components can be found in the terrestrial vegetation section of the draft environmental impact statement. All revised plan alternatives contain desired conditions for grassland and shrubland habitats, with native plant communities that are self-sustaining, where non-native species are in check (not increasing) and plant communities support biodiversity, including a complementary suite of pollinators to sustain native plant communities. These coarse filter components would contribute to suitable foraging habitat for bison over time.

Forested habitats provide shelter for bison from environmental conditions such as temperature extremes and biting insects (Adams and Dood 2011). Forests with more open canopies provide shelter as well as limited forage. All revised plan alternative contain coarse filter components to maintain forested habitats within the natural range of variation, including measurable desired conditions for tree size class and forest density (as measured by canopy cover). Broadly speaking, to achieve desired conditions in forested habitats, management actions would strive to increase tree size class and decrease forest density class in the montane and subalpine forest types most likely to be used by bison. This strategy would maintain or improve bison habitat in forested areas by creating more open, park-like conditions in some areas, which would provide shelter and some forage for bison, and also could improve permeability for bison to move through forested habitats between suitable foraging areas.

Compared to the current plan, plan components in the revised plan alternatives include greater detail about vegetation conditions, including plant species composition, structure, and function. Such details provide better information for management of grassland, shrubland, and forest environments, which would contribute to biodiversity and ecological integrity of these habitats, and serve to maintain, restore, or improve resilience to environmental stressors over time. These factors would provide greater habitat benefits to bison than the current plans.

Effects from Timber Management

All revised plan alternatives identify areas that are suitable for timber production, which includes areas where growing, tending, harvesting and regenerating crops of trees for commercial purposes may be emphasized. Timber harvest would generally benefit bison, as removal of standing trees make more nutrients available for, and stimulate production of, grasses, forbs and shrubs that provide forage for bison. However, such benefits would be temporary, as trees grow back. Different methods of timber management would result in a variety of structural and functional vegetation conditions. Regeneration harvest would create openings that would provide greater volume of forage and remove impediments to bison travel through such areas. Size and shape of openings created through regeneration harvest in the revised plan alternatives would be designed to mimic openings created by natural processes. All revised plan alternatives specify that clearcutting and other methods of regeneration harvest are to be used only where deemed appropriate for multiple resource needs, including wildlife habitat. Reforestation through natural regeneration or planting of seedlings would occur, reducing suitability of these areas for bison over time. Precommercial thinning and intermediate harvest treatments in forested habitats would reduce tree density, improving bison mobility through these areas, and also allowing more sunlight to penetrate to the ground, thereby stimulating production of grasses, forbs and shrubs in the understory, providing some forage for bison as they move through treated areas.

In concert with bison habitat guidelines, timber management actions could be strategically located and timed within or near bison management zones to facilitate expansion of the zones, and increased distribution of bison on the Custer Gallatin. Alternative D would be treat the most acres with timber harvest, which could include projects designed to enhance habitat for bison. Alternative E would result in the most regeneration harvest, creating larger openings that would benefit bison where it occurs in proximity to Yellowstone Park.

Effects from Fire and Fuels Management

Under all revised plan alternatives, fire would play a major role in creating landscape mosaics that support vegetation diversity that benefits bison. Fires contribute to nutrient cycling, which can increase grassland productivity and associated forage conditions for bison. Fire also plays a valuable role in reducing conifer encroachment into grasslands, aspen groves and riparian areas that support bison. All revised plan alternatives include increased objectives for wildfires and prescribed burning relative to the existing plans. As with timber harvest, wildland fire could be used in concert with bison management guidelines to increase habitat suitability within and near bison management zones, strategically creating conditions conducive to expansion of bison zones over time. Alternative D would likely result in the most acreage of prescribed fire use on the Custer Gallatin, which would benefit bison where it occurs within or in close proximity to bison management zones.

Under all revised plan alternatives, fuels management would be emphasized within the wildland urban interface and adjacent to infrastructure to protect values at risk from wildfire. Fuel reduction projects often result in habitat improvement for bison, by removing trees and other woody materials that can impede growth of grasses and other forage species for bison. Bison may be attracted to areas treated for fuel reduction by a flush of high quality forage, which could result in increased incidents of bison-human conflict if bison move into residential, recreation, or other areas with higher densities of humans.

Fire suppression can result in over-dense forest conditions and conifer encroachment into grasslands, which can affect the availability of movement corridors as well as forage quality and quantity for bison. The revised plan alternatives support the important ecological role of fire to a greater degree than the existing plans, as evidenced by higher objectives for wildland fire on the landscape.

Effects from Invasive Species Management

Invasive plant species can out-compete native plants for resources, which can result in community dominance by non-native plants. While bison may eat non-native plant species, and have the ability to digest lower protein, poor quality forage (Adams and Dood 2011), native plant communities provide better quality forage for bison and other grazing mammals. All alternatives include plan components designed to ensure that management actions minimize spread and prevent establishment of invasive plant species on National Forest System lands and adjacent areas, to provide for healthy, resilient plant communities. Of the revised plan alternatives, D has the highest objective for noxious weed treatment. Alternative E treatment objective is substantially lower than traditional levels of treatment which could impact native habitats. Invasive species management direction could be used in concert with bison habitat management guidelines to focus treatment in bison management zones and adjacent areas, to create conditions conducive to expansion of bison management zones over time. .

Effects from Land Allocations

All revised plan alternatives contain forest plan allocations for recommended wilderness areas, backcountry areas, and recreation emphasis areas. Similar to the recreation opportunity spectrum classes discussed above, forest plan allocations dictate what types of management actions and recreation use may occur in certain areas. Bison may react defensively to human presence, which can cause severe injury or death to humans that approach bison. Bison injuries to humans are quite rare, but typically result from humans approaching the bison at unsafe distances. All revised plan alternatives include a goal to provide educational materials to help Forest visitors understand wild bison behavior and act accordingly to avoid conflicts. Most instances where bison have posed a threat to human safety or property have occurred at developed sites such as campgrounds. In such cases, bison may be harassed (hazed), or in rare instances, lethally removed (Interagency Bison Management Plan 2017). Forest plan allocations can dictate the types of facilities (for example developed sites) that may be located in different areas.

Recommended wilderness areas prohibit new developments such as campgrounds, picnic areas, resorts, etc., where people often congregate. Fewer facilities generally result in lower densities of human use, with associated lower probability of bison-human interaction. Backcountry areas are generally low development as well, with fewer facilities than other areas of the Custer Gallatin, resulting in dispersed human use rather than concentrated use. In the Absaroka Beartooth Mountains and Madison, Henry Lakes, and Gallatin Mountains Geographic Areas, alternatives B and C have a combination of recommended wilderness area and backcountry areas, whereas alternative D has only recommended wilderness area, and alternative E has only backcountry areas. Recreation emphasis areas are places with higher levels of development, and expected higher densities of human use where there may be more opportunities for bison to encounter people. Under all revised plan alternatives, recreation emphasis areas are proposed along the Gallatin River in the western year-round bison management zone, and along the Yellowstone River in the northern bison management zone. Under alternatives B, C and E, Zone 2 of the western bison management area would also be a recreation emphasis area.

Bison distribution on the Custer Gallatin has been extremely limited in recent years, providing little data upon which to base effects analyses. However, bison-human interactions in Yellowstone Park are generally associated with developed sites, and rarely occur in backcountry areas of the park (Interagency Bison Management Plan 2017). Therefore it is logical to assume similar conditions on the Custer Gallatin. As a result of forest plan allocations, human uses would be most dispersed under alternative D, which would present the lowest risk for bison-human conflicts. Alternatives B and C would also disperse human use, but at lower levels than alternative D. Alternative E would have the largest amount of recreation emphasis areas, no recommended wilderness area, and a moderate amount of backcountry area, giving this alternative the most potential to concentrate human use, with associated higher risk of bison-human conflict that could have negative impacts on individual bison. This analysis was based on data from Yellowstone Park, where bison attacks on humans infrequently occur. Bison are not hunted in Yellowstone Park, and hunted populations of wildlife tend to behave differently than non-hunted populations, often with enhanced wariness and increased avoidance of humans (Montana FWP 2015c). Since the bison population on the Custer Gallatin would be hunted, it is reasonable to assume that bison human conflicts would be rare and manageable. Therefore bison-human conflicts are not expected to be a major factor in Forest management under any alternative.

Effects from livestock Grazing Management

When bison began migrating out of Yellowstone Park into Montana, the primary issue was concern that bison would transmit brucellosis to domestic cattle grazing on Forest Service allotments and private land. There has yet to be a confirmed case where bison have transmitted brucellosis to cattle in the wild, not because such transmission is not possible, but rather because the two species have been effectively separated generally by moving bison off the national forest before livestock are turned onto grazing allotments. All revised plan alternatives acknowledge bison as a native species of wildlife whose presence and long-term persistence on the Custer Gallatin is a desired condition. As described above, guidelines vary by alternative as to whether management actions would favor bison or livestock in the event of a conflict between the species.

All alternatives include a goal for livestock allotments that become vacant to be evaluated for designation as a forage reserve allotment to be used with authorized livestock when needed. However, alternative D includes a goal that grazing allotments vacated by permittees be evaluated for closure to allow for ecological enhancement, including for the purpose of reducing risk of disease transmission between domestic and wild animals. Leaving vacant grazing allotments within or near bison management zones open as forage reserves for livestock would maintain a degree of risk that could weigh against future decisions about expanding bison management zones. The goal in alternative D to evaluate closure for ecological enhancement would not mandate closure of vacant allotments, but would allow for consideration of allotment closure where doing so would enhance bison distribution within management zones, and facilitate expansion of bison management zones to include larger areas of the Custer Gallatin National Forest.

Finally, all revised plan alternatives contain a guideline that new or reconstructed livestock fences should be located and designed to minimize collision hazards and barriers to wildlife movement. Livestock fences on the Custer Gallatin do not present barriers to bison movement. Bison are large, powerful, and agile creatures, fully capable of breaking through, or jumping over, most types of fencing used to contain livestock on Forest Service allotments. However, livestock fencing can pose a hazard to bison, and injury may occur if bison intentionally or unintentionally collide with, or become entangled in fencing material. Strategic location of fences may reduce the risk of bison encounters with livestock fencing. Fences can be designed so that they may be dropped during times when livestock are not present on allotments, reducing the hazard to bison moving through the area. Fences can be made to be more easily detected by wildlife by placing flagging or other moving parts on the fence to catch the attention of wildlife, or can be made with smooth, rather than barbed wire for the top and bottom strands so that bison and other wildlife can pass over or under the fence with less risk of injury.

Effects from Infrastructure (Roads and Trails) Management

All revised plan alternatives include the desired condition that the Custer Gallatin transportation system provides for safe and efficient travel and access to the national forest, with minimal impacts on natural resources, including wildlife. Bison on roadways can be a traffic hazard for humans, and collisions with vehicles can result in bison mortalities. Most National Forest System roads are narrow, gravel surface routes that support generally low speed travel (< 35 mph), with low probability of vehicle collisions with bison. However, a number of state and federal highways travel through or between Custer Gallatin administrative units. A forestwide goal would encourage Forest Service cooperation with highway managers, state agencies and landowners to create highway crossings for wildlife that reduce risk of collision with vehicles.

Meagher and others (2002) reported that, beginning in the 1980s, winter human use (including plowing and grooming) of road systems in Yellowstone Park resulted in snow compaction that in certain circumstances, created travel corridors that eventually facilitated bison movement out of the park and onto the Custer Gallatin. After studying this possible phenomenon in Yellowstone Park, Bjornlie and Garrott (2001) found that while bison did travel on road systems in winter, they were more likely to travel off roads. Further, road travel by bison was negatively correlated with grooming of road systems, in that the highest winter use of roads by bison occurred outside the road-grooming periods. These authors concluded that groomed roads in Yellowstone Park had minor influence on bison distribution, and that because the bison population had reached or exceeded the winter carrying capacity in the park, bison migration onto adjacent National Forest System lands likely would have occurred regardless of road systems. Very few Forest System Roads are groomed or plowed in winter, and most that are maintained for winter use are located in areas of the Custer Gallatin not occupied by bison in winter. Therefore, effects from forest infrastructure management would have low impact on bison, and would be the same under all revised plan alternatives.

Effects from Recreation Management

All revised plan alternatives include desired conditions that recreation facilities and their use have minimal impacts on resources, including wildlife. Bison in Yellowstone Park have demonstrated a high tolerance level for human presence, although they can be disturbed or displaced by human activities. Winter is a critical time of energy balance for wildlife, including bison, and therefore winter recreation has the greatest potential for impacts to bison. Trail grooming and snow compaction resulting from winter recreation use could influence bison distribution on the Custer Gallatin, but likely to a low degree based on studies conducted in Yellowstone Park. Borkowski and associates (2006) studied behavioral responses of bison to snowmobile use in Yellowstone Park, and found that bison have lower response to snowmobile use than elk. Bison more frequently responded to snowmobiles by looking up briefly and then resuming previous behavior, than actively responding by moving away, and very seldom responded defensively; for example charging snowmobilers. Bison were more likely to respond actively (for example move away) if snowmobiles encountered bison on the roadway, or if snowmobilers deliberately approached bison. Bison responses to snowmobiles actually declined as snowmobile use increased, suggesting some level of habituation to the activity. These authors found no evidence that snowmobile use in Yellowstone Park has had negative impacts on the bison population.

The primary influence of the forest plan on winter recreation is through the recreation opportunity spectrum classification, which would dictate the type of uses allowed. Generally, the recreation opportunity class does not change notably within or near the bison management zones. Minor differences among alternatives in the amount of primitive winter recreation opportunity class versus the amount of semi-primitive, nonmotorized recreation opportunity class would have little notable impact on wintering bison, because winter recreation use in both recreation opportunity classes is limited to quiet, nonmotorized types of recreation such as skiing, snowshoeing, and hiking. Since motorized equipment allows humans to travel further faster, changing the recreation opportunity spectrum class from nonmotorized to motorized (or vice versa), may affect bison. Inside the bison management zones, only alternative D would notably change the winter recreation opportunity spectrum class from motorized to nonmotorized, generally in the areas surrounding the Cabin Creek Recreation and Wildlife Management area. Alternative D then, would result in more quiet areas, with more difficult human access in the western year-round bison management zone. There would be no notable difference between alternatives in winter recreation due to changes in recreation opportunity spectrum class for the northern bison management zone or zone 2 of the western bison management area. Similar to the bison management zones, alternative D would result in considerable changes from motorized winter class to nonmotorized class at the geographic area scale. Alternative D would change roughly 7 percent of the Absaroka Beartooth Mountains Geographic Area and roughly 7 percent of the Madison, Henrys Lake, and Gallatin Mountains Geographic Area from motorized winter recreation opportunity spectrum class to nonmotorized, again providing more quiet areas with potentially lower levels of human use for bison to utilize in winter. The other revised plan alternatives would result in only minor (less than 1 percent) change in winter recreation opportunity spectrum classes in both the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas, which would have no notable effect on bison.

Research evaluating bison responses to motorized winter recreation in Yellowstone Park concluded that snowmobile use does not have notable impacts on the bison population (Borkowski et al. 2006). However, snowmobile use in Yellowstone Park is limited to designated routes, whereas many areas of the Custer Gallatin are open to dispersed snowmobile use, the effects of which have not been directly studied for bison. The other notable difference is that bison are not hunted in Yellowstone Park, but can be hunted on the Custer Gallatin National Forest. Snowmobiles could provide access for bison hunters in some areas, if winter bison distribution increases on the Custer Gallatin. In that case, alternative D would provide bison more options to avoid hunters, and would also provide hunters more quiet opportunities to hunt bison, compared to all other alternatives.

Cumulative Effects

The framework for management of Yellowstone bison is found in the Interagency Bison Management Plan (IBMP), which was developed by the National Park Service, Forest Service, Animal & Plant Health Inspection Service, Montana Fish Wildlife and Parks, and the Montana Department of Livestock. The IBMP was formally adopted by these agencies in 2000. Three Tribal entities: the Confederated Salish & Kootenai Tribes, the Inter Tribal Buffalo Council, and the Nez Perce Tribe, joined as Interagency Bison Management Plan voting members in 2009 (www.ibmp.info). The Interagency Bison Management Plan is an adaptive management plan, in which operating procedures are periodically updated, including annual updates since 2012 (Interagency Bison Management Plan 2017). Under the guidance of this plan, the Yellowstone bison population has been managed at a relatively stable level, allowing for increased numbers and distribution of bison on the Custer Gallatin Forest over time. This cooperative management strategy is expected to continue in a manner that would be consistent with forest plan components under all alternatives.

Conclusion

All revised plan alternatives take an affirmative stance to acknowledge the key ecological role of bison in the Yellowstone ecosystem and on the Custer Gallatin Forest. The revised plan alternatives all contain desired conditions for continued bison presence on the Custer Gallatin, allowing bison to pioneer and establish new migration routes, resulting in expanded distribution of bison on the Custer Gallatin. Alternatives B, C and D would be more proactive, by setting objectives for bison habitat improvement projects, and favoring bison management over livestock management within the bison management zones. All revised plan alternatives would avoid management actions that would impede bison expansion on the Custer Gallatin, and would promote strategic habitat management within and near existing bison management zones to produce conditions that would allow for progressive expansion of bison management zones and bison distribution over time. Alternative D would be the most proactive for bison, with a desired condition for a year-round, self-sustaining population on the Custer Gallatin, higher objectives for habitat improvement projects, and no exceptions for management actions specifically designed to control bison movement. Of the revised plan alternatives, E would be the least proactive for bison, with desired conditions for bison presence on the Custer Gallatin, but no set objectives for habitat improvement projects, and a guideline that would emphasize livestock operations over bison presence. Under the current plans (alternative A) the plans would remain silent to bison habitat management, and the Custer Gallatin would take a lesser role in proactive management to encourage bison expansion on the Custer Gallatin. In summary, all alternatives would support long-term persistence of bison on the Custer Gallatin National Forest, including increased bison numbers, distribution and time spent on the national forest. Supporting more bison on the Custer Gallatin could accommodate a moderate increase in the effective population size of Yellowstone bison, thereby contributing to genetic health of the species.

3.10.5 Unique Wildlife Habitats

The Custer Gallatin National Forest administers over three million acres of federal land, including two different ecosystems, the montane ecosystem covering the west and central part of the Custer Gallatin National Forest, and the pine savanna ecosystem to the east. The montane ecosystem includes the Absaroka Beartooth Mountains; Madison, Henrys Lake, and Gallatin Mountains; Bridger, Bangtail, and Crazy Mountains; and Pryor Mountains Geographic Areas. The pine savanna ecosystem includes the Ashland and Sioux Geographic Areas. This vast landscape provides an incredibly diverse range of habitats for wildlife. Detailed descriptions of ecosystem characteristics, structure, function, processes, existing conditions, and effects of the various forest plan alternatives are found in other sections of this document, as identified below. This section will tier to those analyses, and briefly describe some of the more unique habitats on the Custer Gallatin, with a synopsis of species associated with those habitats and conditions. Many of the species associated with these unique habitats, and therefore included in this section, are currently on the Regional Forester's sensitive species (RFSS) list (see appendix C for a list of the RFSS species), but would remain so only under the existing plans.

Aquatic and Riparian Habitats

Aquatic and riparian habitats are addressed in detail in the watershed, aquatics and riparian section, as well as the terrestrial vegetation section of the draft environmental impact statement. These features include lakes, rivers, streams and ponds, and the vegetative communities such as willow and shrub riparian areas, wetlands, bogs, fens, and marshes that occur at the interface between water bodies and upland habitats. Riparian areas are typically saturated with water at least seasonally. Riparian areas support incredibly high diversity of plant and animal communities (Naiman et al. 1993), particularly given their relative rarity on the Custer Gallatin landscape. Riparian areas provide water, food and shelter to a great many terrestrial wildlife species. Given their configuration on the landscape, riparian areas serve as transitional zones between aquatic and terrestrial ecosystems, which are often used as travel corridors, providing important habitat connectivity for wildlife. Nearly all terrestrial wildlife species use riparian areas or aquatic habitat for at least some part of their daily, seasonal or life cycle needs, and some species are very dependent upon aquatic or riparian habitats.

Species associated with aquatic or riparian habitat on the Custer Gallatin include the bald eagle (*Haliateeus leucocephalus*), harlequin duck (*Histrionicus histrionicus*), and trumpeter swan (*Cygnus buccinator*) to name just a few. Compared to when the current plans were written, bald eagle populations have been increasing in the conterminous United States (USDI FWS 2016c), Montana (DuBois 2016), and South Dakota (Deisch, S. South Dakota GFP, 2018c. pers. comm.), with higher numbers observed across the entire Custer Gallatin Forest as well. Trumpeter swan populations have also increased in recent years in Montana (Marks et al. 2016) and South Dakota (Deisch, S. South Dakota GFP, 2018c pers. comm.), with important winter habitat for this species located near Hebgen Lake in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area. The Rocky Mountain breeding population of harlequin ducks is relatively stable, with local declines noted for some areas in Montana (Marks et al. 2016). There is insufficient data to determine trends for this species on the Custer Gallatin Forest.

The suite of plan components included in the revised plan alternatives for aquatic and riparian habitats are designed to maintain or restore the ecological integrity of these vital habitats on the Custer Gallatin. The plan components in the revised plan alternatives are more detailed, and generally more restrictive than riparian habitat direction in existing plans. Aquatic and riparian associated species, including at risk species and Regional Forester's sensitive species, would persist on the Custer Gallatin under all alternatives.

Rock, Cliff, and Cave Habitats

Rock, cliff, and cave habitats are formed primarily by geologic processes, although some human activities, particularly those associated with mineral extraction, can create, or alter underground or surface structures that may provide unique habitats for wildlife. Caves are geologic features on the landscape that provide unique habitat elements for a number of wildlife species (refer to the caves and karst analysis under energy, mineral and geologic areas in the draft environmental impact statement for more detailed information on caves), most notably bats (see the northern long-eared bat section in the draft environmental impact statement for additional information on bats A number of bat species occur on the Custer Gallatin Forest, including but not limited to the fringed myotis (*Myotis thysanodes*), long-eared myotis (*M. evotis*), long-legged myotis (*M. volans*), pallid bat (*Antrozous pallidus*), spotted bat (*Euderma maculatum*), and Townsend's big-eared bat (*Corynorhinus townsendii*). These bat species occur at a variety of locations across the Custer Gallatin, and all have been detected in the Pryor Mountains Geographic Area. These bat species hibernate in winter, typically in caves, but occasionally in underground mines as well. Several bat species are vulnerable to white-nose syndrome, a fungal disease that affects hibernating bats. Aside from minimizing human spread of the fungus, this stressor is largely beyond the control of the Forest Service to manage, because the fungus is also spread from bat to bat, and there are currently no known effective control mechanisms.

Some hibernating bas have experienced high mortality rates in the eastern U.S. from white-nose syndrome. The fungus that causes white-nose syndrome has not yet been detected on the Custer Gallatin, but the fungus, and at least one infected bat, were recently confirmed nearby in South Dakota and Wyoming. White-nose syndrome is a relatively new issue for bats, particularly in the western United States, and there are many uncertainties about how it might affect western bat populations given the differences in species, environments, and roosting behavior. The existing forest plans do not address this issue. All revised plan alternatives contain plan components to directly address the potential human-caused spread of the fungus that leads to white-nose syndrome in bats.

Cliffs are used as nesting habitat by a number of bird species, including the peregrine falcon (*Falco peregrinus*) and the prairie falcon (*F. mexicanus*), the latter of which is a species of particular interest for South Dakota Game Fish and Parks associated with cliff and rock formations in the Sioux Geographic Area. The breeding population of peregrine falcons increased dramatically after a federal ban on harmful pesticides and subsequent re-introduction effort, resulting in the species being removed from the endangered species list in 2000. Peregrine falcon breeding sites on the Custer Gallatin have been consistently occupied. Prairie falcons are not consistently monitored, but populations in Montana are believed to be stable (Marks et al. 2016). South Dakota is on the eastern fringe of the prairie falcon's breeding range, and the species is uncommon, but present in the Sioux Geographic Area. Surveys in the South Dakota units of the Sioux Geographic Area in 2011 found notably fewer prairie falcon nests compared to surveys in the same area in the 1970s (Deisch, S. South Dakota GFP, 2018c pers. comm.). Other than limited recreational use, forest management actions generally do not target cliff habitats. The revised plan alternatives include guidelines to limit management actions that may disturb nesting raptors, which would protect breeding sites for peregrine and prairie falcons. Since peregrine falcon nest sites are typically associated with wetlands and water bodies (Marks et al. 2016), the riparian management zone plan components in the revised plan alternatives would provide additional protections for peregrine falcon breeding sites compared to the current plans.

A number of reptile species are associated with rocky, sandy habitats typically found in warmer, drier portions of the Custer Gallatin. Examples include the greater short-horned lizard (*Phrynosoma hernandesi*), milksnake (*Lampropeltis triangulum*), and western hog-nosed snake (*Heterodon nasicus*). Where information exists, populations of these species appear relatively stable at the range-wide scale (Deisch, S. South Dakota GFP, 2018c pers. comm.). However, there is very limited information on these species over much of the Custer Gallatin. These species may be associated with rocky, sandy beaches or dry river banks, which would generally be protected from disturbance with the increased restrictions for riparian management zones under the revised plan alternatives. The revised plan alternatives also include a guideline to limit ground disturbing activities near known reptile and amphibian reproductive areas and hibernacula during breeding and wintering seasons. Existing plans do not specifically address habitats for reptiles and amphibians, but do provide special emphasis for Regional Forester's sensitive species habitats. Management actions typically do not target rocky, sandy areas that may be important for these species; however specific guidelines in the revised plan alternatives would provide greater protection for known breeding and wintering areas than the existing plans.

Recently Burned Forest Habitats

Fire is the primary ecological process that has influenced vegetation species composition, structure and connectivity on the Custer Gallatin. Recently burned forests provide food and shelter for a variety of wildlife species, with some species having a strong association with recently burned areas. Woodpeckers are commonly associated with burn areas due to an abundance of prey species where insects feed on trees injured or killed by fires. The black-backed woodpecker (*Picoides arcticus*) is strongly associated with recently burned forests, using fire-killed trees for nesting and foraging sites (Bonn et al. 2007). The revised plan alternatives all recognize the important ecological role of fire on the Custer Gallatin, including the contributions to a diversity of habitat conditions for fire-adapted wildlife species. The area burned by wildfires was reduced from the 1940s to the 1980s due to a combination of fire exclusion, timber harvest, livestock grazing and climate. During this time, fuel levels increased, resulting in larger fires on the Custer Gallatin starting about the time the existing plans were written (see Affected Environment in the terrestrial vegetation section of the draft environmental impact statement for details). Consequently, post-burn habitat has been increasing, particularly in the pine savanna ecosystem, but with reasonable distribution across the Custer Gallatin. Black-backed woodpecker trends have been stable to increasing on the Custer Gallatin in recent years (IMBCR unpublished data).

The revised plan alternatives include an objective for wildfire acreage on the Custer Gallatin, to acknowledge the ecological benefits of allowing fires to burn under appropriate conditions. Recently burned forests are often targeted for salvage harvest to capture the economic value of burned timber. The revised plan alternatives contain requirements for retention of unburned patches, trees burned at low severity, and clusters of burned trees with a variety of sizes, including very large snags, in salvage harvest areas. In addition, snag retention guidelines in the revised plan alternatives would require more, and larger snags be left in harvest areas than currently required. Collectively, the revised plan alternatives would better support persistence of species associated with snags and recently burned habitat than the existing plans.

Grassland Habitats

Grasslands habitats are addressed in detail in the terrestrial vegetation section of the draft environmental impact statement. Grasslands are a relatively minor habitat component in the montane ecosystem compared to the pine savanna ecosystem. Notable grassland-associated species on the Custer Gallatin include bison, bighorn sheep, and white-tailed prairie dogs, which are all addressed separately in the draft environmental impact statement. Other notable grassland associates include black-tailed prairie dogs (*Cynomys ludovicianus*), burrowing owls (*Athene cunicularia*), Baird's sparrows (*Ammodramus bairdii*), and long-billed curlews (*Numenius americanus*). Black-tailed prairie dogs occur in areas of relatively flat topography, with looser soils for digging burrows, and short-grass vegetation types devoid of sight-limiting trees and shrubs (Montana Prairie Dog Working Group 2002). These conditions are naturally limited on the Custer Gallatin, primarily found in the pine savanna ecosystem. Black-tailed prairie dogs are currently present only in the Ashland Geographic Area, where colony size is generally small at less than 100 animals, but has been remained relatively stable over the life of the existing plans. Black-tailed prairie dogs are more common, with much larger colonies, outside the national forest boundary. Livestock grazing is a prominent use in the pine savanna geographic areas, which contributes to the short grass structure favored by black-tailed prairie dogs. Burrowing owls are also associated with short-grass prairies, and are strongly associated with prairie dog towns, which provide both food and shelter for the owls. Burrowing owls were declining at a non-significant rate in Montana between the mid-1960s and early 2000s (Marks et al. 2016), with a similar trend (slight decline) in South Dakota (Deisch, S. South Dakota GFP, 2018c pers. comm.). However, monitoring and multi-species conservation efforts for prairie and grassland birds has improved the outlook, and recently resulted in a downgrading of the Montana rank for the burrowing owl from "at risk" to "potentially at risk" (Montana FWP 2015a).

Baird's sparrows are fairly common breeding residents in eastern Montana and populations appear stable in Montana while declining elsewhere (Marks et al. 2016). However, the species has only been detected once in regular bird surveys on the Custer Gallatin Forest, providing insufficient evidence that the species is established or becoming established within the plan area. Long-billed curlews are shorebirds associated with short grass prairies. Range-wide surveys suggest increasing populations in recent years (Ibid), with slight declines in South Dakota (Deisch, S. South Dakota GFP, 2018c pers. comm.). Curlews and their habitats are relatively uncommon on the Custer Gallatin, with no trend information due to low density and limited survey effort.

The revised plan alternatives include specific plan components related to vegetation composition that would contribute to biodiversity and ecological integrity of grassland habitats. Compared to the existing plans, the revised plan alternatives provide more detail regarding vegetation conditions and species composition to maintain or move toward desired conditions for grasslands. The revised plan alternatives also include direction to reduce invading conifers, control the spread of invasive annual grasses and noxious weeds, and promote habitat diversity, all of which would benefit grassland species. The revised plan alternatives include specific direction for prairie dogs, which would be more protective than existing direction, benefitting both prairie dogs and associated species, such as the burrowing owl. Collectively, the revised plan alternatives would promote more proactive management of grassland habitats, and benefit associated species to a greater degree than existing plans.

Shrubland Habitats

Shrubland habitats are addressed in detail in the terrestrial vegetation section of the draft environmental impact statement. Many wildlife species on the Custer Gallatin use shrub habitats to meet daily, seasonal or year-round needs. Shrubland are a very minor habitat element on the Custer Gallatin, representing just about four percent of the land base, and often occurring as an extension of shrublands from adjacent lands outside the national forest boundary. As such, many wildlife species that are strongly associated with shrubland types are not year-round residents on the Custer Gallatin. In the pine savanna ecosystem, shrublands typically occur as irregular patches, in narrow bands or small, dense thickets. In the montane ecosystem, some shrublands may be found at higher elevations, but are present on a relatively small scale. Notable wildlife species that are shrub associates include the Greater sage-grouse, which is a sagebrush obligate, and the white-tailed prairie dog, which is a grass and shrub-associated species. These two species are addressed in more detail under species of conservation concern in the draft environmental impact statement.

Other shrub-associated species on the Custer Gallatin include the Regional Forester’s sensitive species Blue-gray gnatcatcher (*Polioptila caerulea*) and Loggerhead shrike (*Lanius ludovicianus*). These migratory songbird species breed in shrubby habitats on the Custer Gallatin. The Blue-gray gnatcatcher is found only in the Pryor Mountains Geographic Area, which is the only area where this tiny songbird is commonly found in the state of Montana (Marks et al. 2016). Breeding has also been confirmed for this species in the Sioux Geographic Area in South Dakota (Deisch, S. South Dakota GFP, 2018c pers. comm.). This species’ establishment on the Custer Gallatin indicates a fairly recent range expansion, as the historic range for the species is well south and east of the Custer Gallatin. Loggerhead shrikes are fairly uncommon breeding residents on the Custer Gallatin, with highest densities in the Ashland and Sioux Geographic Areas of the pine savanna ecosystem, where they may be found in woody draws and grassy areas with scattered trees and shrubs. Breeding bird surveys indicate insignificant declines for the species in Montana since the mid-1960s (Marks et al. 2016), with significant declines in South Dakota over roughly the same time period (Deisch, S. South Dakota GFP, 2018c pers. comm.). However, local surveys do not show a notable population trend for this species on the Custer Gallatin, indicating relative stability at this time (IMBCR, unpublished data).

All revised plan alternatives contain specific plan components related to vegetation composition, structure and function that would contribute to biodiversity and ecological integrity of shrublands on the Custer Gallatin. Compared to the existing plans, the revised plan alternatives provide more detail regarding desired conditions, as well as specific restrictions on management actions such as new developments and livestock grazing to minimize impacts on shrublands and woody draws. Additional components for greater sage-grouse habitat in the revised plan alternatives would also provide more protection for shrublands than current direction. Collectively, the revised plan alternatives provide more detailed, integrated and ecologically based plan components that would benefit shrub-associated species to a greater degree than the revised plan alternatives.

Coniferous Forest Habitats

Coniferous forest habitats are addressed for a multitude of factors in the terrestrial vegetation section of the draft environmental impact statement. The Canada lynx and Northern long-eared bat are two at risk species that are strongly associated with forest habitats, as addressed separately above. While many, perhaps even most, terrestrial species on the Custer Gallatin Forest depend on coniferous forest habitats for at least some part of their life cycle, there are few true forest-obligates in the at-risk categories, or currently on the Regional Forester's sensitive species list. Many of the bat species addressed previously that use cave habitats as roost sites and winter hibernacula, forage, and shelter in coniferous forests, but also use riparian areas to a large degree. Large trees, late successional forest and old growth provide a high degree of biodiversity on the Custer Gallatin, including vital habitat elements for a wide range of terrestrial wildlife species. The northern goshawk (*Accipiter gentilis*) and American (pine) marten (*Martes americana*) are species with known affiliations for mature to over-mature forest conditions, including the presence of large trees, snags and logs, and relatively high canopy cover. While these individual habitat components are most abundant in mature and old growth forest, they can be found in earlier successional stages as well. Based on detection surveys, goshawks are present and well distributed across the Gallatin portion of the Custer Gallatin National Forest (USDA FS 2016a), and occur on the Custer portion of the national forest as well. Pine martens are trapped for fur and consequently, market value can influence population trends. Martens are fairly common in forested habitats on the Gallatin portion of the national forest, but occur at lower densities in the isolated mountain ranges of the Bridger, Bangtail and Crazy Mountains Geographic Area, where easy access for trappers may be a factor (Ibid).

Other species associated with forest habitats include the flammulated owl (*Otus flammeotus*), which is associated with open park-like structure typically found in ponderosa pine forests, as well as more generalist species like the gray wolf (*Canis lupus*), which is associated with a wide variety of forest conditions, mostly as they relate to the availability of big game prey species. Flammulated owls have only been detected once on the Custer Gallatin, and the detection was never verified (for example detected by sound, not verified through observation or DNA). Subsequent surveys for flammulated owls failed to detect the species on the Custer Gallatin. Ponderosa pine habitat is limited to the pine savanna ecosystem, which is well outside the known range for this species. Gray wolves were reintroduced in Yellowstone National Park in the mid-1990s. Since then, wolves have expanded to occupy most of the suitable habitat in the montane ecosystem of the national forest.

The revised plan alternatives all include desired conditions for increased numbers of large trees (at least 15 inches diameter or larger) and distribution of large forest size classes, plus old growth forest that is maintained or increased relative to existing conditions. Associated guidelines limit the types of management actions allowed in old growth forests, specify number, size and conditions for snags to be retained within treatment areas, and stipulate how vegetation management should retain, and promote recruitment of, large size class trees. Additional guidelines specify the amount of coarse woody debris that should be left as ground cover after vegetation management projects. Further, the revised plan alternatives contain desired conditions for coniferous forest habitats to be managed within the natural range of variation for tree species composition, structure, size class, density, and landscape pattern. These components would provide specific habitat elements required by species associated with mature and old growth forest structure, as well as a wide range of conditions to support the variety of habitat needs for more generalist species.

Conclusion

All revised plan alternatives contain a collection of coarse-filter vegetation components combined with fine-filter species-specific plan components designed to maintain or restore the ecological integrity of the habitats within the Custer Gallatin Forest. Collectively the plan components in the revised plan alternatives would maintain or move habitat conditions toward the natural range of variation to which wildlife have adapted, which would support long-term persistence of native species, including Regional Forest sensitive species and at-risk wildlife species, with greater certainty than existing plans.

3.10.6 Connectivity

Introduction

The 2012 Planning Rule requires that the plan must include components, such as standards or guidelines, to maintain or restore the ecological integrity of ecosystems on the Custer Gallatin, including plan components to maintain or restore connectivity. As it pertains to wildlife, connectivity is defined as the ecological conditions that exist at several spatial and temporal scales that provide landscape linkages that permit the daily and seasonal movements of animals within home ranges, the dispersal, and genetic interchange between populations, and the long distance range shifts of species, such as in response to climate change (36 CFR 219.19).

Habitat connectivity is widely recognized as a crucial component for maintaining biodiversity and managing for sustainable populations of native species (USDA FS 2006, Western Governors' Association 2008, Hansen 2009, McIntyre and Ellis 2011, Parks et al. 2012, Cushman et al. 2012, Wade et al. 2015, Haber and Nelson 2015, Mclure et al. 2016). While habitat connectivity is a prominent topic in the scientific literature, with specific focus on the Greater Yellowstone Area (the montane portion of the Custer Gallatin, excluding the Pryor Mountains), there is very limited information regarding terrestrial habitat connectivity in the pine savanna portion. There are two primary requirements for habitat connectivity. The first is that suitable habitats are present for species of interest, and the second is that landscapes are permeable to wildlife movement.

Conditions that present habitat suitability, as well as barriers to movement, vary widely between species. It follows logically that landscape connectivity also differs by individual species, based on daily, seasonal, and lifetime habitat needs. Corridors that facilitate movement by one species may not be suitable, and may even present barriers for movement of another species. Similarly, landscapes that facilitate dispersal out of the home range for a species may not provide habitat required to support long-term occupation by that same species (McClure et al. 2016). For example, large, unbroken tracts of mature forest cover are important to forest carnivore species such as Canada lynx and American marten. Yet for other species, including pronghorn antelope, bighorn sheep, and black-tailed prairie dog, dense forested habitat is not suitable, and conifer encroachment into grassland or shrub-steppe habitats can reduce habitat suitability and impede movement for these species. Forest cover can provide security cover to facilitate movement of big game species such as elk, deer, moose, and bear; however these same species also rely on forest openings and grass and shrub habitats to find adequate forage. Similarly, Ruediger and others (2000) noted that dispersing lynx will move through large areas of limited forest cover, but such habitat is generally not considered suitable for residential (long-term) use by lynx.

Habitat connectivity is also influenced by the dispersal capability of species and individuals. For example, with the ability to fly, birds are capable of moving between habitat patches on a daily basis, making long-distance migratory movements between seasonal habitats more easily than ground-based terrestrial wildlife. Generally, large-bodied animals have greater dispersal capability than smaller animals. For example, while they occupy similar habitats, the wolverine, a mid-sized forest carnivore, has much greater dispersal capability than the fist-sized American pika (*Ochotona princeps*) (Parks et al. 2012). Connectivity corridors identified as high priority for conservation of biodiversity are often identified from observed movement patterns of large-bodied, wide-ranging species. However, wide-ranging animals capable of long-distance movements are often habitat generalists, and therefore may not adequately represent the habitat needs, or dispersal capabilities of other species (Cushman et al. 2012).

The reason for movement also plays a role in the functionality of habitat connectivity. For example, long-range dispersal movements may contribute to gene flow between populations, genetic rescue of small or isolated populations, and colonization of new areas (Parks et al. 2012). Habitats used to move within an individual's seasonal home range may be quite different from those used for movement between seasonal ranges, and can be dramatically different than areas used for dispersal to establish new home ranges. Not all movements undertaken by animals are beneficial. Movement to escape a possible predator or other disturbance can place an animal in unfamiliar territory. Likewise, exploratory movements outside of home ranges are often undertaken by inexperienced sub-adult animals, which may relocate that animal into less suitable, or even unsuitable habitat (Wade et al. 2015).

Haber and Nelson (2015) defined structural connectivity as "the physical relationship between patches of habitat…" and functional connectivity as "the degree to which landscapes actually facilitate or impede the movement of organisms and processes of ecosystems." They noted that fragmentation, which is the breaking-up of contiguous patches into smaller, disconnected patches, can introduce barriers to connectivity. While this notion is informative in the evaluation of landscape connectivity, it is important to consider that habitat in the Rocky Mountains (including the montane ecosystem of the Custer Gallatin National Forest) is naturally more patchily distributed than in other parts of the United States, such as the North American prairie (Hansen 2006), which is more similar to parts of the pine savanna ecosystem.

Popular methods for modeling wildlife movement corridors include landscape resistance modeling, often referred to as "least cost path" or "least cost corridor" models, which operate under the concept that animals will choose to travel along routes with the least ecological cost (that is, the lowest cumulative resistance between their current and target locations on the landscape). Least cost movement models assume that all such paths or corridors contribute equally to connectivity on the landscape, that all animals have equal dispersal capability (Parks et al. 2012), that animals are goal-oriented and have the desire to move between their current and target locations, and that animals have absolute knowledge of their surrounding landscape (Wade et al. 2015; McClure et al. 2016). Circuit theory models provide an alternative to least cost models, by applying concepts related to flow of charged bits through an electrical circuit, to animal movement through the landscape. Circuit theory models assume that repeated use of routes between source and target locations infers better flow between points. In contrast to least cost models, circuit theory models assume that animals have no previous knowledge of the surrounding landscape. Therefore, one might expect least-cost models to be more representative of traditional movement patterns between seasonal ranges of herd animals (where there is collective knowledge of the landscape), whereas circuit models might be more useful for identifying exploratory or dispersal movements of animals out of known home range territories (McClure et al. 2016).

Habitat connectivity and movement corridor modeling has promising utility for the identification of high priority areas for protection or restoration, in order to sustain functional connectivity across the landscape. However, such models are generally based on many assumptions. Wade and others (2015) examined a number of resistance-surface-based models (least cost models) and identified a considerable number of issues with such modeling efforts, such as failure to specify the temporal aspect of potential corridors (daily, seasonal or lifetime movement, for example), the purpose for modeled connector routes (for example foraging, breeding, and dispersal), or the biological rationale for selection of model-assigned resistance features. These authors stressed that process modeling (such as for wildlife movement) is often based on assumptions that are not supported by data.

Model validation with independent, empirical data is of course desirable, but not always possible. Further, while methods for validating connectivity models against empirical data exist, they have not been standardized (McClure et al. 2016). On the other hand, without any validation, the reliability of a model is basically unknown. In the absence of empirical data, expert opinion is a commonly used basis to derive model parameters. Many such connectivity models are based on general assumptions about habitat characteristics that are believed to have commonalities for a majority of species; for example low level of human impacts, or a high degree of intact forest cover. While expert opinion has value, it is the least robust method of model validation. To illustrate the importance of model validation, Wade et al. (2015) gave an example where independent radio-tracked movement of animals was substantially different than the corridors predicted by a least cost model, and remarked that because animals are influenced by independent needs, such as seeking food or avoiding predators, strict adherence to a least cost path is not likely.

An alternative method to evaluate habitat connectivity as it relates to ecosystem integrity is to examine the amounts, distribution, and status of human development and access within the Custer Gallatin and surrounding landscape. Construction of roads, mines, administrative sites and developed recreation areas results in relatively permanent habitat alteration that affects connectivity for wildlife. Certain land management allocations restrict the types and amounts of development and associated use allowed on National Forest System lands. Land use restrictions can add a degree of protection for important wildlife habitat components such as habitat security, which helps maintain habitat connectivity. This evaluation operates on the premise that designation of areas such as wilderness, wilderness study, and inventoried roadless, regulates the amount of habitat loss, degradation, and fragmentation that occurs due to human activities (Belote and Aplet 2014, Dietz et al. 2015), and that the resulting network of designated areas provide core habitats that facilitate conservation of habitat connectivity for wildlife movement (Montana FWP 2011). Although designated areas typically provide a higher degree of overall habitat connectivity for wildlife by restricting the amount of permanent habitat alterations that may be inflicted by humans, all Federally-owned lands generally provide protection from permanent residential and urban development, yet allow for some level of resource utilization and associated transportation systems.

Analysis Area

Habitat connectivity is a key factor contributing to ecological integrity, and was therefore examined across the entire forest. However, the montane and pine savanna ecosystems within the Custer Gallatin differ considerably in terms of ecological characteristics, habitat types, wildlife communities, and availability of specific research, so these ecosystems were also examined separately. Finally, the 2012 rule requires consideration of plan area contributions within the broader landscape, by taking into account existing conditions outside the national forest boundaries that may influence the plan area’s ability to maintain or restore ecological integrity. Accordingly, connectivity was analyzed for a spatial extent encompassing all lands within 100 miles of any Custer Gallatin National Forest administrative unit (figure 41).

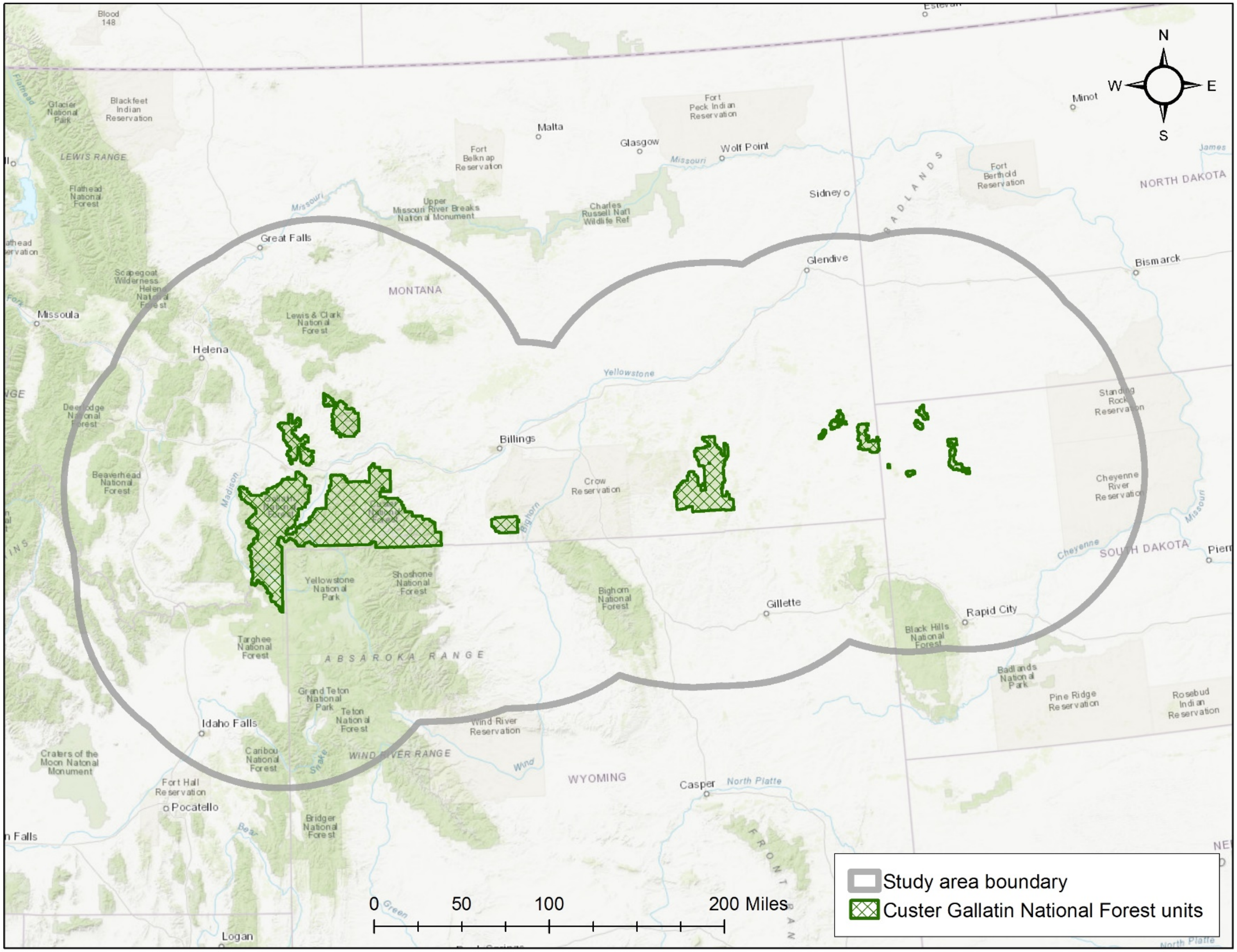

Figure 41. Habitat connectivity analysis area

Affected Environment (Existing Conditions)

The montane ecosystem in the western portion of the Custer Gallatin includes the Madison, Henrys Lake, and Gallatin Mountains; Absaroka Beartooth Mountains; Bridger, Bangtail, and Crazy Mountains; and Pryor Mountains Geographic Areas. These areas collectively are characterized by mountainous terrain with high topographic relief, ranging in elevation from just under 6,000 feet to well over 12,000 feet. Vegetation varies from semi-arid sage-steppe, to moist meadows and riparian areas, montane and boreal forest, and alpine tundra. The Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas in the montane ecosystem represent the largest contiguous block of relatively undeveloped wildlife habitat on the Custer Gallatin. The pine savanna ecosystem in the eastern portion of the Custer Gallatin is characterized by rolling plains and tablelands of moderate relief. The Ashland and Sioux Geographic Areas stand out from the surrounding plains due to their elevation (roughly 3,000 to 4,000 feet) and the presence of ponderosa pine forest and woody draws amongst the rolling grassy plains. The Ashland Geographic Area is a moderately sized contiguous block of relatively undeveloped land, whereas the Sioux Geographic Area is comprised of eight small, distinct units. While there are some similarities in wildlife communities across the Custer Gallatin, due to the considerable ecological differences between these ecosystems, there are notable differences in wildlife habitats and species composition as well. Broadly speaking, species common to both the montane and pine savanna ecosystems tend to be more habitat generalists, whereas the more specialized species occur in one system or the other, but not both.

The Custer Gallatin National Forest is made up of a number of distinct administrative units, some of which are isolated from the rest by mostly private lands. This geographic separation is the most difficult factor to manage for in terms of habitat connectivity, because the Forest Service has no authority over lands separating the distinct administrative units of the Custer Gallatin. Nonetheless, the geographic spread of the Custer Gallatin, which is over 400 miles from west to east, is a factor in habitat connectivity and associated movement of organisms. Given the spatial separation and dramatic ecological differences between the montane and pine savanna ecosystems, it is a logical assumption that wildlife movement between these ecosystems was historically low relative to movement within each ecosystem. Other than bird (and perhaps bat) species, there is likely a low level of wildlife interchange between the montane and pine savanna ecosystems currently as well.

The montane ecosystem of the Custer Gallatin, is part of the Greater Yellowstone Area, which is perhaps the largest intact ecosystem in the continental Unites States (McIntyre and Ellis 2011), and one of the largest intact temperate zone ecosystems in the world (Ebinger et al. 2016). While the Greater Yellowstone Area is world renowned for its ecological contributions, it is geographically isolated from other intact and important ecosystems. For the Custer Gallatin portion of the Greater Yellowstone Area, the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas are contiguous with Yellowstone National Park to the south and east respectively. The Absaroka Beartooth Mountains Geographic Area is also adjacent to the Shoshone National Forest, with much of the shared boundary within the Absaroka-Beartooth wilderness. The Madison, Henrys Lake, and Gallatin Mountains Geographic Area also abuts the Beaverhead-Deerlodge National Forest to the west, with much of this shared boundary within the Lee Metcalf wilderness. The Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas of the Custer Gallatin provide a considerable amount of habitat connectivity between Yellowstone National Park, the Lee Metcalf, and the Absaroka Beartooth wilderness areas. The Bridger, Bangtail, and Crazy Mountains Geographic Area is separated from the rest of the montane ecosystem by Interstate 90 (a two-lane frontage road) and a railroad, which all run parallel to each other, as well as private land that is developed to varying degrees. This geographic area is mostly surrounded by private land, except where the Custer Gallatin Forest abuts the Helena Lewis and Clark National Forest at the north end of the Crazy Mountains. The Bridger, Bangtail, and Crazy Mountains Geographic Area has been identified as potentially important for connectivity between the Greater Yellowstone Area and the Northern Continental Divide Ecosystem to the north (Walker and Craighead 1997, Cushman et al. 2009, Peck et al. 2017). The Pryor Mountains Geographic Area is separated from the rest of the montane ecosystem by a mosaic of private and Bureau of Land Management land. While the Pryor Mountains Geographic Area is relatively isolated from the rest of the Custer Gallatin, it is contiguous with Bureau of Land Management land to the west, south and east, and with the Crow Indian Reservation to the north, all of which are relatively undeveloped landscapes with few barriers to wildlife movement.

Much of the available scientific information on habitat connectivity embraces a concept of connecting core habitats, wherein core habitats are often identified as areas that have a high degree of “naturalness” and corresponding low level of human modification (Theobald 2013, Belote et al. 2016). Such areas typically have some degree of protection from permanent development and associated habitat loss (Western Governors’ Association 2008, Cushman et al. 2012, Montana FWP 2011, McIntyre and Ellis 2011, Theobald et al. 2012, Belote and Aplet 2014, Wade et al. 2015, McClure et al. 2016). As such, protected areas such as designated wilderness that impose restrictions on land uses, are often used as surrogates for “naturalness” of landscapes. Designated wilderness areas permanently bar most human-caused conversion of natural land cover. Natural disturbance events are generally allowed to occur without management interference (although wildfire is sometimes suppressed), and management activities and recreational pursuits are limited to primitive means. Other designated areas such as inventoried roadless areas, recommended wilderness, wilderness study areas, and research natural areas generally preclude permanent conversion of natural land cover, with a goal to maintain a mostly natural state, but some limited management activities, including low levels of resource utilization, are allowed. Parts of the Custer Gallatin outside of designated areas can be managed more intensely for uses such as timber harvest and mining, as well as recreational uses that may involve permanent developments such as roads, trails, and campgrounds, which may affect habitat connectivity for wildlife.

Roughly, 35 percent of the land base within the Custer Gallatin National Forest is in designated wilderness. These areas, which include parts of the Absaroka-Beartooth, and Lee Metcalf Wilderness Areas, are intended to preserve wilderness character on the landscape, thus providing large blocks of wildlife habitat relatively undisturbed by human development and by association, some of the best habitat connectivity for wildlife. All of the designated wilderness on the Custer Gallatin Forest is located in the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas. In addition to designated wilderness, another 28 percent of the Custer Gallatin falls within other designated areas, including inventoried roadless and wilderness study areas, which restrict the amount of road construction and associated activities, but still allow for some resource utilization and may contain permanent developments such as trail systems and occasional rustic cabins or other facilities. The only wilderness study area is located in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area, whereas all geographic areas except the Sioux) contain some inventoried roadless area (see the Inventoried Roadless Area section of the Designated Areas section of the draft environmental impact statement).

Less than half (37 percent) of the Custer Gallatin Forest is not within a designated area, and is therefore more readily available for higher levels of resource utilization and recreational development than are designated areas. In general, National Forest System lands regardless of land management allocations provide a higher degree of protection for wildlife habitat than do many areas outside of the national forest boundary, particularly private land, which may have little or no protection from permanent conversion of the landscape. Inside the national forest boundary, most non-federal inholdings are small, isolated parcels, with management actions similar to multiple use activities on Federal lands outside of designation areas. However, it should be noted that there are large blocks of non-federal lands, most notably in the Big Sky area in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area, as well as the west side of the Bangtail Range in the Bridger, Bangtail, and Crazy Mountains Geographic Area, that are already developed to some degree and subject to further development.

The majority of permanent conversion of natural vegetation to a non-vegetative condition, hence resulting in a permanent loss of habitat on the Custer Gallatin, is attributable to the road and trail system, and associated parking areas. Other permanent developments such as campgrounds, picnic areas, administrative sites, etc. account for a relatively minor amount of permanent habitat conversion that contributes to habitat fragmentation, and at a small scale, impacts habitat connectivity. In addition to removing vegetation, forest roads and trails can affect hydrology, with associated impacts on water quality, wetlands, and riparian habitats (The Wilderness Society 2014), which can also affect habitat connectivity for wildlife. Roads and trails not only affect habitat connectivity for some species with permanent alteration of habitat, but human use on roads and trails creates a disturbance factor that may cause avoidance by wary animals, reducing the effectiveness of otherwise suitable habitat surrounding the road or trail. Each individual road or trail can influence habitat connectivity at a small scale, and density of multiple roads and trails can affect suitability of habitat for wildlife at a larger scale. It is well documented that higher road densities can negatively affect the way some animals use habitat, including avoidance of otherwise suitable habitat, which can affect overall connectivity.

The Wilderness Society (2014) conducted a literature review for effects of transportation infrastructure (roads and trails) on wildlife, and cited several studies that found a broad scale threshold for maintaining functional landscapes for large mammals required road densities below 1 mi/mi^2. However, it should be noted that the scale at which road densities were calculated for the studies cited was not provided. Using a moving window analysis to calculate the proportion of motorized access route density classes across the Custer Gallatin provides a method for comparison. This analysis shows that 72 percent of the entire Custer Gallatin Forest has motorized access route density at or below 1 mile per square mile. This figure varies by geographic area, with the Absaroka Beartooth Mountains Geographic Area having the highest amount at 89 percent and Ashland and Sioux Geographic Areas at the lowest with 53 percent of each area, showing that all geographic areas currently have at least half the area in a condition that provides functional landscapes for large mammals to move through, and that the largest geographic areas have the greatest proportion of area with relatively low motorized access route densities. In addition to large mammals, the Wildlife Society review (ibid.) showed most reptiles, amphibians and birds responded negatively to higher road densities, small mammals responded either positively or not at all to higher road densities, and mid-sized mammals showed negative or neutral effects to higher road densities, supporting the notion that habitat connectivity is different for different species, or guilds of animals.

Relative to road and trail impacts on habitat connectivity and wildlife movement, the Gallatin Forest Travel Management Plan incorporated an assessment of biological corridors, and identified important linkage areas near the national forest boundary, where wildlife movement is desirable for genetic exchange between blocks of National Forest System lands, but likely to be restricted by permanent development such as highways, railroads, agricultural lands and residential areas. As a result, the Gallatin Travel Plan includes a goal to provide for wildlife movement and genetic interaction, and an objective to provide habitat connectivity consistent with wildlife movement patterns between mountain ranges within the national forest boundary. Travel management plans for the Custer Forest also considered wildlife corridors but identified no specific areas for management constraints.

The Custer Gallatin includes parcels across all of southern Montana and into the northwestern corner of South Dakota. As such, it covers a broad range of ecological conditions, covering large, medium and smaller land masses, each with unique capability to provide connectivity for ecological processes, as well as the large number of plant and animal species known to occur within the national forest boundary. Fine-filter connectivity models focus on individual species or populations, and are frequently based on detailed, site-specific, empirical data. A fine-filter connectivity assessment for each species and ecological element on the Custer Gallatin is not just infeasible, it is not necessarily the best approach given the lack of empirical data to drive such analysis. To tackle the issue of evaluating habitat connectivity for many species simultaneously, the Forest Service partnered with the Center for Large Landscape Conservation and developed a modeling framework specific to the Custer Gallatin Forest (see Appendix B for details on methods used in this process). The model was based on a series of generic species, which are conceptual species whose ecological requirements are designed to reflect the needs of a group of real species, and to represent various combinations of preferred habitat type, perceptual range, and dispersal capability. This approach has been applied to other connectivity conservation modeling efforts (Watts et al. 2010, Foster et al. 2017, Lechner et al. 2017), and it attempts to strike an appropriate balance between fine-filter connectivity models designed for individual species and coarse filter models that are completely species neutral.

Core areas of high quality habitat were mapped for each generic species, representing combinations of five habitat type preferences including coniferous forest, alpine, grassland and shrubland specialists, plus habitat generalists. Model parameters reflected two body sizes of large or small, under the assumption that an animal’s body size was positively correlated with its perceptual range as well as dispersal capability. Core areas contained relatively homogenous patches of preferred vegetation for specialist species and vegetation mosaics for habitat generalists. Patch size required for core habitat was based on the generic species’ body size and individual perceptual range, which is the distance at which an animal is sensitive to edge or difference in habitat condition. The model estimated landscape conductance representing an animal’s ease of movement across the landscape (Zeller et al. 2012), assuming that a preferred habitat type with minimal human modification was easiest to move through (Theobald et al. 2012). The model then generated a series of paths connecting core habitats using different assumptions about animal movement behavior. Predicting random movement along non-optimal paths assumed an animal has imperfect knowledge of its surroundings. This “random movement” model output is similar to circuit theory connectivity modeling, and is more reflective of dispersal movement to establish a new home range. Paths predicting deliberate movement between core habitats in an optimal fashion to minimize the total cost of movement assumed an animal has perfect knowledge of its surroundings. This “optimal movement” model output is similar to least-cost-patch connectivity modeling, and more representative of experienced individuals making daily movements or seasonal migrations within an established home range.

Not surprisingly, these modeling efforts showed markedly different spatial patterns of connectivity value for different generic species with more specialized habitat needs. For example, portions of the Custer Gallatin predicted to have the greatest connectivity value for large-bodied, coniferous forest specialists showed very little overlap with shrubland, grassland or alpine-associated species. Also not surprising is that the random movement simulations resulted in more diffuse patterns, and consequently larger areas of high value for habitat connectivity than the optimal movement simulations, which showed more concentrated and linear movement patterns.

Model outputs for large-bodied species revealed areas of high connectivity value linking core habitats within, between, and beyond Custer Gallatin administrative units across the larger landscape covered by the connectivity analysis. These longer-distance connections resulted from the greater dispersal capacity for large-bodied species assumed in model parameters. In contrast, model outputs for smaller-bodied species tended to highlight connections over much smaller spatial scales within individual core habitat areas, with relatively little connectivity indicated between core habitat areas or between Custer Gallatin administrative units. Results for smaller-bodied species were highly sensitive to random locations of starting and ending points (for example model nodes), with alternative model runs suggesting different patterns of connectivity within core habitat areas. The connectivity variation for smaller-bodied species is attributed to computational limitations created by the large spatial extent of the study area (for example broader landscape scale), which encompassed an area roughly the size of the state of Montana. Better understanding of within-patch connectivity for smaller-bodied species would require additional analysis at a finer resolution, or more site-specific level, which is not the appropriate scale for this type of programmatic evaluation.

Habitat connectivity was greatest for alpine and coniferous forest species in the montane geographic areas and highest for grassland-associated species in the pine savanna geographic areas. Model outputs indicated that habitat connectivity for shrub-associated species is quite limited on the Custer Gallatin, but rather occurs at lower elevations between Custer Gallatin Forest administrative units.

Both random walk and least cost path modeling results for the Custer Gallatin showed the highest value of connectivity habitat for alpine-associated species in the Beartooth Plateau area of the Absaroka Beartooth Mountains Geographic Area, and almost entirely within the Absaroka-Beartooth Wilderness. Moderately high values for alpine-associates were also indicated in the Crazy Mountains of the Bridger, Bangtail, and Crazy Mountains Geographic Area, as well as the Madison Range of the Madison, Henrys Lake, and Gallatin Mountains Geographic Area, with corresponding linkage paths between the geographic areas for large-bodied species. Alpine habitat of the Crazy Mountains is largely within checkerboard landownership, with a considerable amount of private land, but nearly all of the National Forest System lands with high value alpine habitat are inventoried roadless areas. Alpine habitat in the Madison Range is largely within the Lee Metcalf Wilderness. The Absaroka Beartooth Mountains, Madison, Henrys Lake, and Gallatin Mountains and Bridger, Bangtail, and Crazy Mountains Geographic Areas all showed high value random walk habitat connectivity for coniferous forest associates, with least cost path concentrations in the Absaroka Mountains of the Absaroka Beartooth Mountains Geographic Area, the Gallatin Crest, Cherry Creek, and Taylor-Hilgard Peaks of the Madison, Henrys Lake, and Gallatin Mountains Geographic Area, as well as the west flank of the Bridger and Crazy Mountains in the Bridger, Bangtail, and Crazy Mountains Geographic Area. In the Absaroka Beartooth Mountains and Madison, Henrys Lake, and Gallatin Mountains Geographic Areas, the least-cost paths for forest associates fell largely within the Absaroka-Beartooth Wilderness, Lee Metcalf Wilderness, or the Hyalite-

Porcupine-Buffalo Horn Wilderness Study Area. The west flank of the Bridger Range is largely inventoried roadless area, as is the national forest portion of the west Crazy Mountains, but with interspersions of private land.

The Ashland Geographic Area and Long Pines unit of the Sioux Geographic Area showed the highest random walk habitat connectivity for grassland associate species and also contained concentrations of least-cost-paths for grassland species in the southeast corner of the Ashland Geographic Area and the southern portion of the Long Pines. These geographic areas have no designated wilderness. The Ashland Geographic Area contains three inventoried roadless areas that overlap with some of the high-quality random movement habitat connectivity values for grassland species. According to the model, the highest habitat connectivity values for grassland-associated species occur in multiple-use areas of the Ashland and Sioux Geographic Areas. While there are no designated areas with inherent land-use restrictions in these geographic areas, other than the three Ashland inventoried roadless areas, there are fewer permanent residents and visiting recreationists in the eastern portion of the Custer Gallatin, resulting in lower human demands on the landscape.

The model showed generally low habitat connectivity values for shrub-associated species on the Custer Gallatin. Shrub habitats on the Custer Gallatin typically occur as small, dense thickets, narrow bands, or irregular patches. Shrublands are frequently found at lower elevations, near the national forest boundary as extensions from adjacent lands, but may also be found at higher elevations in relatively small patches. Mesic montane shrubs may occur in larger patches, but are frequently intermingled with coniferous forest. Riparian shrubs are associated with water sources. As a result, shrublands are naturally quite limited on the Custer Gallatin, accounting for just under 4 percent of the total land base, which supports model results showing low habitat connectivity for shrubland species on the Custer Gallatin.

Model outputs for habitat generalists produced large contiguous blocks of core habitat that included core areas for all habitat specialists, as well as mosaics of different vegetation types. Core areas for habitat generalists were separated only by major human modifications, such as highways passing through or near the national forest boundary. Consequently, nearly all of the Custer Gallatin Forest provides core habitat for generalist species. Connectivity between core areas for habitat generalists is also predicted to be of highest quality in areas of low or no human modification.

Key Stressors

Land conversion resulting from human development for transportation, residential, commercial, recreational or agricultural purpose, results in a permanent habitat loss, as well as major disturbance factors, and increased mortality risk for many wildlife species.

Habitat fragmentation occurs when a disturbance or development changes existing vegetation to a condition that is substantially different from adjacent or surrounding conditions. Habitat fragmentation can have negative effects on individuals or species that are strongly associated with homogenous vegetation types, particularly those species that require large, contiguous blocks of consistent vegetation types. Conversely, habitat diversity resulting from fragmentation may benefit more generalist species, or may benefit more species by providing a variety of vegetative structure and function.

Environmental Consequences

Management Direction under the Current Plans

Habitat connectivity is not necessarily a new concept, but the science is emerging relative to other basic ecological principles. Neither the Custer nor Gallatin existing plans contain specific direction for habitat connectivity, other than general references to migratory species. Both plans contain direction to protect a variety of key wildlife habitats, which collectively, have provided for good habitat connectivity over the life of the existing plans. For example, both plans contain direction for riparian habitat management, forage emphasis areas, and security cover for wildlife, all of which are crucial elements that provide water, food, and shelter, and which collectively contribute to overall habitat connectivity. The Custer Plan was visionary in recognizing and anticipating the reintroduction of gray wolves into Yellowstone Park and subsequent expansion of the species onto the Custer Gallatin. The Gallatin Forest Plan specifically acknowledged the importance of wildlife resources, including migratory species, not only as they relate to the Gallatin Forest, but also in the larger context. In the preface, the plan recognizes the significance of the Greater Yellowstone Area and has been designed to complement the management of the entire Greater Yellowstone Ecosystem, and coordinate the use and management of the forest's resources with other national forests, national parks, and agencies involved. This plan contains a provision to maintain natural elk migration patterns in the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area.

Effects of the Current Plans

Management under direction of the existing plans has resulted in good habitat quality and connectivity for wildlife within the national forest boundary, as evidenced by the fact that the Custer Gallatin currently supports the complete suite of native fauna that existed prior to development of the original plans, including renewed presence of some species, such as bison, and recovery of a number of previously listed species, including the peregrine falcon, bald eagle and gray wolf, which were all absent, or present at very low numbers when the existing plans were written, and which are now all present on the Custer Gallatin with stable to increasing populations. The grizzly bear, another federally listed species, has also thrived under existing plan direction, with increased numbers and distribution within and outside of the recovery zone on the Custer Gallatin. New species have been listed since the plan was written, including the Canada lynx and northern long-eared bat, and subsequent direction was amended to the plans to address known risk factors for lynx. However, there is limited evidence that the Custer Gallatin was ever a stronghold for either species, and is definitely on the very edge of the historic range for the northern long-eared bat. The wolverine, a species that has been proposed for listing under the Endangered Species Act since the original plans were written, is still present and well distributed on the Custer Gallatin, and has received special emphasis under existing plans as a Regional Forester's sensitive species.

Forest transportation systems (such as roads, trails, and associated use) have been identified as factors that can contribute to habitat fragmentation, cause disruption of normal wildlife behavior patterns, and increase direct mortality risk for a variety of wildlife species. Since the original forest plans were implemented, both the Gallatin and Custer Forests have completed travel management plans that are complementary to forest plan direction and specifically address wildlife habitat and connectivity issues related to location, design, type of use and density of transportation features. These plans have resulted in access management that has contributed to maintenance and restoration of habitat connectivity for wildlife across the Custer Gallatin.

Finally, habitat connectivity for wildlife is necessarily an issue that must be addressed not only within the national forest boundary, but at the broader landscape, as wild animals do not recognize administrative boundaries, and many have life cycle requirements that cannot be wholly met within the national forest boundaries. This factor requires cross boundary coordination and cooperation with other landowners and jurisdictions. Existing forest plans acknowledge this need with broad direction for coordination with state wildlife management agencies, the U.S. Fish and Wildlife Service, adjacent forests, and Yellowstone National Park. Under this direction, the Custer Gallatin (independently as separate forests as well as unified since consolidation), have participated in interagency committees and working groups that facilitate communication and coordination across political and administrative boundaries, resulting in numerous habitat restoration projects for wildlife. Examples include, but are not limited to: implementation of a Greater Yellowstone Ecosystem-wide food storage order to minimize wildlife-human conflicts associated with improper storage of attractants; establishment of a whitebark pine seed orchard to produce genetically resistant seedlings for restoration of whitebark pine habitat across the Greater Yellowstone Ecosystem; wildlife migration corridor summits; annual monitoring of a major raptor migration corridor; livestock allotment closures to reduce conflicts with native species such as grizzly bears, bison and bighorn sheep; beaver reintroductions to restore riparian habitats that provide important movement corridors for both terrestrial and aquatic species; and systematic inventories for bats. These are but a few examples of coordinated, cooperative actions in which the Custer Gallatin has engaged with multiple entities to maintain or restore wildlife habitat and associated connectivity, even in the absence of specific plan direction to do so. Existing plan direction has fostered cross-boundary coordination for wildlife habitat management, which would continue, but with a lack of specific direction based on emerging science.

Management Direction under the Revised Plan Alternatives

All revised plan alternatives contain a suite of plan components that either contribute to or directly address habitat connectivity for wildlife. All Forestwide general desired conditions (FW-DC-WL) address some element of habitat connectivity for wildlife, such as species diversity, abundance, distribution, security, refuge, recovery, and habitat within the natural range of variation. These are factors that cannot be maintained without adequate habitat connectivity. In addition, specific plan components indicate that landscape patterns provide habitat connectivity for wildlife, and habitat conditions provide structural and functional diversity, are resilient to existing and predictable future stressors, thereby supporting natural movement patterns for a wide variety of species. All revised plan alternatives contain multiple goals to work across administrative boundaries to maintain or restore habitat connectivity for wildlife, acknowledging that a broader landscape perspective is vitally important for animal movement and genetic interchange that contributes to biological diversity and ecological integrity. To achieve these desired conditions and goals, the revised plan alternatives include a guideline to minimize barriers to wildlife movement. Alternatives B, C and D apply specific guidelines to avoid permanent habitat alterations, and limit temporal aspects of disturbance within areas identified as key linkage areas for wildlife movement.

Effects of the Revised Plan Alternatives

Compared to existing plans, the revised plan alternatives would all take a more affirmative, proactive approach to maintain or restore habitat connectivity for wildlife, through incorporation of specific, science-based desired conditions and goals for coordinated management, which are supported by a series of objectives and guidelines that promote habitat enhancement and limit management actions with potential for negative impacts on wildlife habitat connectivity. Alternatives B, C, and D would all incorporate additional forest plan allocations with associated land use restrictions for areas of known, or intuitive importance for wildlife movement as key linkage areas. Alternative E would not result in additional plan allocations for key linkage areas, but rather would depend on protections afforded by existing designated areas, forest plan allocations for multiple resources, and other collective plan components to maintain or restore habitat connectivity for wildlife.

All revised plan alternatives contain a desired condition for a complete suite of native species on the Custer Gallatin, with sufficient numbers and distribution to be adaptable to changing conditions for long-term persistence. This desired condition adopts a more landscape-scale perspective, while acknowledging that the Custer Gallatin is one of the few areas where a nearly complete suite of native fauna known to be present prior to European settlement are still present today. The only known exception is the black-footed ferret (*Mustela nigripes*), which was historically present in the pine savanna geographic areas, but has long since been extirpated from the Custer Gallatin. This desired condition statement provides a framework that would support re-introduction efforts for species like the black-footed ferret under the right conditions, and also reinforces the need for future management actions to maintain conditions that support long-term persistence of the many species that still exist, and even thrive here. This same plan component also speaks to the desired condition for wildlife diversity that contributes to ecological processes such as predator-prey relationships, nutrient cycling, hydrologic function, vegetation composition and structure. It specifically recognizes the interrelationship of many elements that contribute to ecological integrity, and would serve to foster a more integrated approach for future management actions with direction that is less prescriptive in favor of a more holistic and adaptive system compared to existing plan direction.

All revised plan alternatives state a desire for vegetation conditions that are generally within the natural range of variation, to provide wildlife habitat for a variety of life cycle needs, including year-round and seasonal use by a diverse array of species. This plan component speaks to the commitment to engage in management practices that emulate natural disturbance patterns and facilitate ecological processes, in order to provide habitat conditions comparable with those to which native wildlife have adapted over time. This plan component relative to wildlife habitat condition is supported by detailed, specific and measurable plan components for terrestrial vegetation, as addressed below.

The revised plan alternatives share a desired condition for habitat that provides security and refuge for wildlife to escape from stresses and threats, whether they be from natural or man-caused disturbance factors. Security is an important factor for habitat connectivity in that animals may resist moving through areas where they feel threatened. Likewise, refugia provide potential staging areas or stepping stones to facilitate wildlife movement through areas that may otherwise produce stressors that could influence natural behavior patterns. The presence of refugia that are relatively buffered from predicted environmental fluctuations may also help to support long distance range shifts of species, such as in response to climate change.

All revised plan alternatives specifically state desired conditions for landscape patterns throughout the Custer Gallatin that provide habitat connectivity for wildlife, particularly wide-ranging species such as medium to large carnivores and wild ungulates. Resulting habitat connectivity facilitates daily and seasonal movement, as well as long-range dispersal of wildlife to support genetic diversity, allowing animals to adapt to changing conditions over time. An assumption for this component is that by providing adequate conditions for large-bodied, wide-ranging species that require larger blocks of suitable habitat to move through, conditions will also be met for smaller-bodied species with shorter dispersal capabilities. This assumption is supported by connectivity modeling results in which locations of core habitat for smaller-bodied species exhibited strong overlap with high-value connectivity areas for larger-bodied species with similar habitat preferences. Since most connectivity for smaller-bodied animals likely occurs within these core areas due to their limited dispersal range, managing the landscape in a manner that protects the connectivity for larger-bodied species should simultaneously protect the highest quality habitat patches, and connections within these patches, for smaller-bodied species.

Another related plan component that applies to all revised plan alternatives states a desire for habitat conditions within the Custer Gallatin, but near the boundaries, to provide structural and functional diversity, and be resilient to existing and predictable future stressors, thereby supporting natural movement patterns for a wide variety of species across administrative boundaries. This plan component recognizes the need to consider the broader landscape and provide a high degree of diversity, to accommodate needs of a wide range of species. While habitat diversity is desirable to support varied needs of many species, habitat diversity could also be perceived as habitat fragmentation by habitat specialists that require relatively large, unbroken patches of homogenous vegetation types. However, the purpose of this component is to provide for the many species inhabiting the Custer Gallatin, rather than the few more specialized species. The concept is to maintain conditions conducive to animal movement through an area, and not necessarily conditions that would support long-term or residential occupation of these areas. The intent is to promote wildlife movement across forest boundaries through adjacent areas, to facilitate long-range dispersals needed to maintain or improve genetic diversity.

All revised plan alternatives also contain multiple goal statements for cooperation and collaboration with other landowners and partners to expand knowledge and coordinate management across boundaries in order to maintain or improve habitat connectivity over a broader landscape. Such coordination has, and would likely continue to occur under existing plans, but the revised plan alternatives would formally address the need for such coordination in future land management activities. Finally, all revised plan alternatives contain a goal to work with willing landowners to acquire or otherwise conserve non-federal lands within the national forest boundary where needed to maintain or restore habitat structure, function, and connectivity. Existing plans contain similar goals, with wildlife habitat as one of many potential resources for consideration, rather than addressing this specific need to provide for habitat connectivity.

The desired conditions and goal statements that are common to all revised plan alternatives give more relevant and focused information specific to habitat connectivity across a highly diverse landscape compared to the broad and more generic desired future conditions and goals stated for wildlife in the existing plans, which predict overall habitat improvements and greater diversity of forest structure. Desired condition plan components in the revised plan alternatives, combined with more detailed and specific goals would give Forest managers a more strategic and holistic conceptual process to help align land use programs with wildlife habitat needs across a varied landscape. In addition to desired conditions and goals, all alternatives include objectives for implementing wildlife habitat improvement projects that could involve restoration of habitat connectivity. Alternative D has the highest objectives for wildlife habitat, whereas alternative E has the lowest. Alternatives A, B and C all have the same objectives for wildlife habitat improvement, in a mid-range between alternatives D and E.

All revised plan alternatives include a guideline that management actions should not create movement barriers to wide ranging species, except where necessary to provide for human or wildlife safety. While certain conditions on the ground may impede movement to some degree for certain species, there are few management actions in which the Forest Service engages that would create a true barrier to wildlife movement, particularly for large-bodied, wide-ranging species that have the ability go over, under, through, across, or around most obstacles. However, large-scale developments or features strategically placed in concert with natural barriers such as a large reservoir or cliff wall, can notably affect permeability of the landscape for wildlife. This guideline would ensure that management actions that could alter the natural environment would be evaluated for possible impacts on movement patterns of wide-ranging species, and require mitigation or revision for those actions that would not maintain or restore habitat connectivity for wildlife. On the other hand, the guideline would allow for management actions specifically designed to restrict wildlife movement when needed to provide for human or wildlife safety. An example would be construction of a fence or other barrier deliberately designed to prevent wildlife from approaching and crossing a highway at an area where vehicle collisions with wildlife are an issue for both human and wildlife safety. Additional modifications could be made to funnel wildlife movement to an area of higher visibility, or even to a wildlife crossing structure. This guideline addresses an issue that is not covered under current plan direction.

Alternatives B, C and D incorporate a forest plan allocation for key linkage areas with associated plan components. The 2012 Planning Rule requires consideration of ecological connectivity at multiple scales to provide landscape linkages that facilitate the movement of species (FSH 1909.12). Many potential landscape linkages were identified in the Custer Gallatin habitat connectivity modeling exercise, but not all were identified as key linkage areas needing additional plant components. For example, some of the highest quality areas for habitat connectivity are already in designated areas, such as wilderness, in which major developments or construction of permanent structures that could present obstacles to wildlife movement would not be allowed. The inherent land use restrictions in designated wilderness provides the protection needed to maintain habitat connectivity, and therefore additional, fine-filter plan components were not necessary. Other areas identified as of high importance for habitat connectivity were located in inventoried roadless areas, which come with their own set of land-use restrictions that would generally maintain habitat connectivity. Also, some parts of the Custer Gallatin identified as highly important for habitat connectivity were in habitat types where there are few known threats to habitat connectivity associated with likely Forest Service management actions. Accordingly, most areas of the Custer Gallatin identified as highly important for habitat connectivity are either protected, or have few management-related threats, and were not singled out for land allocation as key linkage areas or additional plan components with added restrictions.

The locations identified as key linkage areas include the north end of the Gallatin Range in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area and the west side of the Bridger Range in the Bridger, Bangtail, and Crazy Mountains Geographic Area. Refer to the Designations Map in Appendix A. These areas were identified for fine-filter plan components for a number of reasons. They are within the top one percentile of habitat connectivity value for forest associates, and vegetation management actions have the greatest potential for impacts on forested habitats. Interstate 90 and nearby development presents a major impediment or barrier to north-south movement for most land-dwelling wildlife species that occur on the Custer Gallatin. Those capable of getting across the highway face high mortality risk to do so. The key linkage areas in alternatives B, C, and D encapsulate the portions of the Custer Gallatin that are in closest proximity to Interstate 90, and occur as relatively narrow bands that create a natural ecological flow pattern funneling wildlife movement to a point where crossing the Interstate may be attempted to reach a destination. The key linkage areas represent the shortest distance between Custer Gallatin administrative units that would involve a crossing of Interstate 90. Managing National Forest System lands in close proximity to the highway for habitat connectivity would provide potential staging opportunities for wildlife on the move to remain relatively secure until a safe crossing of the highway can be executed. The path between the Gallatin and Bridger Mountain Ranges presents the shortest distance for wildlife to travel between isolated parcels of public (for example low development) lands in a north-south (or vice versa) fashion between larger contiguous blocks of relatively secure habitat. While other important linkage areas are present on the Custer Gallatin, none have the same unique ecological characteristics or management concerns as those identified in the key linkage areas found in alternatives B, C and D.

The key linkage area concept for alternatives B, C and D, is focused on providing landscape connectivity for long-range dispersals under the assumption that managing for connectivity over a broader area to promote more random movement patterns of inexperienced individuals attempting long-range dispersal to establish a new home range, would also provide for more deliberate, often linear movement patterns of resident animals within a home range. This assumption was supported by connectivity modeling results for the Custer Gallatin, which showed all optimal movement corridors (such as those likely to be used for daily or seasonal movements by residents) to be within the more diffuse, broad areas that present many options for random movements of inexperienced animals.

Under alternatives B, C and D, areas with a key linkage area land allocation would be managed in accordance with guidelines that allow for vegetation management with consideration to maintain or enhance habitat connectivity for wildlife, but would also require “rest” periods with no major vegetation management projects for at least four out of every ten years, including two consecutive years. Timing restrictions in key linkage areas would result in periods relatively free from large-scale disturbance that would allow wildlife to flow more freely through the area. This plan component was based at least partially on existing forest plan timing and re-entry standards for grizzly bears and elk. Research has shown that large-bodied, wide-ranging animals such as elk and grizzly bears, will avoid areas of high disturbance, such as those associated with major vegetation management actions; such as logging operations (Lyon et al. 1985, Waller 1992). This research showed that animals were frequently displaced from logging operations during peak activity involving use of heavy equipment, but often returned soon after logging operations were complete. These studies indicated that such disturbance over extended periods of time can result in permanent displacement of wildlife. Accordingly, duration limits for major activities, followed by periods of inactivity, were incorporated into existing plan direction for grizzly bears and elk. However, the research cited and associated plan direction were focused on habitat use by residential animals within home ranges. Dispersal movements, and even migratory movements between seasonal ranges, may occur at different rates (for example animals move more quickly), and may occur through suboptimal habitat conditions (Zeller et al. 2014, Abrahms et al. 2017, Brennan et al. 2018, Vanbianchi et al. 2018). Therefore, timing limits and rest periods for key linkage areas were developed to provide periods of low management activity while allowing some management flexibility.

Under alternatives B, C and D, habitat alteration effects from vegetation management would be temporary as succession and natural disturbance processes continue to change vegetation, and disturbance effects would also be temporary due to requirements for “rest” periods, allowing both experienced and inexperienced animals attempting to move through an area to find areas and time periods free of major disturbances. The requirement for at least two consecutive years of no major vegetation projects would help facilitate multi-year dispersal events. Construction of new permanent facilities or structures, such as roads, trails, campgrounds, powerlines, etc. would generally not be allowed within key linkage areas, unless needed for the specific purpose of addressing ongoing or imminent resource concerns within the key linkage areas. For example, a new hiking trail would not be constructed to accommodate increased demand for hiking opportunities, but an existing hiking trail could be relocated within the key linkage area if contributing unacceptable sediment levels to a stream in the current location. Limiting new permanent structures and facilities within the key linkage area would limit habitat loss and fragmentation associated with human development, and also would limit the amount of disturbance impacts associated with use of human facilities.

Other forest plan allocations may vary by alternative within the key linkage areas. In alternative C, a portion of the southern key linkage area (in the Gallatin Range) would also be allocated as a recreation emphasis area. In areas of dual allocation, the more restrictive direction would apply. Since the key linkage area direction is more restrictive for certain uses than the recreation emphasis area, the entire southern key linkage area would be managed under guidelines for key linkage areas. For example, no new recreation facilities would be allowed within the key linkage area, unless needed to address immediate resource concerns. In alternative C, portions of the northern key linkage area (Bridger Range) would also be allocated as a backcountry area. Again, the more restrictive direction would apply, so new trails for hiking, horseback riding or mountain biking that would otherwise be allowed in a backcountry area could be constructed in the key linkage area only if needed to address immediate resource concerns. Similarly, where salable mineral removal could otherwise occur within the key linkage area subject to timing restrictions, this activity would not be allowed with dual allocation as a backcountry area in alternative C.

In alternative D, portions of both the north (Bridger Range) and south (Gallatin Range) key linkage areas would also have land allocations as recommended wilderness. Since the more restrictive direction would apply, some vegetation management actions that would otherwise be allowed in the key linkage areas would not be allowed in the recommended wilderness area portions. No new temporary or permanent roads would be allowed for any purpose, no new recreation events, no new permanent structures, no mountain bike or motorized use would continue on existing routes, and snowmobiles would be banned from areas currently open for snowmobile use within the recommended wilderness area portions of key linkage areas. Collectively, these restrictions would provide better security for wildlife movement within the recommended wilderness area portions of the key linkage area. However, these same restrictions could prohibit certain vegetation management activities for the purpose of maintaining or enhancing wildlife habitat connectivity. For example, vegetation management projects designed to increase resilience to fire, insects and disease, to improve forage conditions, or to enhance visibility for wildlife might not be allowed in recommended wilderness area portions of the key linkage areas. Likewise, mechanical removal of dense, down timber after a blowdown, fire or other natural disturbance to improve area permeability for wildlife may not be allowed in recommended wilderness area portions. Restrictions tied to recommended wilderness areas could also prohibit construction of features specifically designed to enhance wildlife habitat connectivity. On the other hand, new trails for hiking or horseback riding that would otherwise be allowed in a recommended wilderness area, would not be constructed in the key linkage areas unless needed to address immediate resource issues.

Alternative E has no land allocations for the areas identified as key linkage areas in the other revised plan alternatives, other than the current inventoried roadless areas. Forestwide desired conditions and goals for habitat connectivity would apply, but no specific land use restrictions would be implemented in the

Bridger Range of the north end of the Gallatin Range to facilitate wildlife movement through these areas. Permanent developments would be allowed, to some degree; however, considerable portions of the key linkage areas are inventoried roadless areas, so in those portions, future management actions would follow restrictions for inventoried roadless areas. Alternative E land allocations would be the same as the existing plans, with no added land use restrictions to facilitate wildlife movement in a north-south direction across Interstate 90 and associated developed areas. Alternative E would have less potential than alternatives B, C and D, and alternative A (the current plans) would have the least potential to promote wildlife movement, particularly long-range dispersal of individuals to increase genetic diversity of subpopulations of animals.

Outside of the key linkage areas, high value connecting habitats would be well protected for alpine-associated species, since the highest quality habitats and associated connecting routes, are almost entirely located within designated wilderness areas. Management actions generally are not targeted in alpine habitats, and would not affect habitat connectivity within major core areas under all alternatives. Individuals may attempt dispersal movements between large blocks of core alpine habitats in different geographic areas, but such dispersal would require movement through suboptimal habitat for these species regardless of management actions.

Highest-value core areas and connecting habitats for forest-associated species are located in the Absaroka Beartooth Mountains, Madison, Henrys Lake, and Gallatin Mountains and Bridger, Bangtail, and Crazy Mountains Geographic Areas of the montane ecosystem. The top one percentile of forested connectivity habitat is primarily located in designated areas, with roughly 90 percent of the best random movement habitat and 83 percent of the best optimal connecting paths found in designated wilderness or inventoried roadless areas, which each have a set of land use restrictions. Therefore, land management actions that could impact habitat connectivity for coniferous forest associated species would be relatively restricted under all alternatives. Additional restrictions apply to high value forested habitats in the key linkage areas (described above) under alternatives B, C, and D.

Alternative D would add recommended wilderness land allocation and associated restrictions to most areas that are of high value for habitat connectivity in forested landscapes that are in inventoried roadless areas. Alternative D would prohibit new structures, major recreation events, motorized and mechanized use on trails, which would reduce disturbance impacts on animals, but would also limit the types of tools and techniques that could be used to maintain or restore habitat connectivity if needed. Alternatives B and C would add similar combinations of recommended wilderness and backcountry areas to high value forested habitats in inventoried roadless areas. Backcountry areas would have more restrictions for adding permanent structures than inventoried roadless areas, but otherwise would be managed similarly. Alternative E would add backcountry allocations to forested areas along the Gallatin Crest, which is currently in a wilderness study area, and inventoried roadless area, so alternative E would be similar to the current plans in highly connected forest habitats.

Habitat connectivity for grassland-associated species is greatest in the pine savanna ecosystem, with highest quality values found in the southern part of the Ashland Geographic Area and a small amount in the Long pines unit of the Sioux Geographic Area, and moderate levels of connecting habitat between these core areas. There are no designated areas (such as wilderness or inventoried roadless) in the high value connectivity areas for grassland species in the Ashland or Sioux Geographic Areas. Under all revised plan alternatives, coarse-filter plan components for grassland habitats provide greater detail than existing plans, including desired conditions for grassland community composition, structure and function, which would serve to maintain or restore habitat connectivity for grassland-associated species in the pine savannah ecosystem. Grasslands are a relatively minor habitat on the Custer Gallatin. Livestock grazing is the primary use of grassland habitats in the Ashland and Sioux Geographic Areas. Pronghorn antelope are large-bodied grassland associates that have increased in both numbers and distribution in the pine savannah ecosystem geographic areas (http://fwp.mt.gov/fishAndWildlife/management/, Deisch, S. South Dakota GFP 2018b. pers. comm.), indicating good habitat connectivity in these areas. Therefore, no additional (fine-filter) components were included in the revised plan alternatives for grassland habitats.

Overall habitat connectivity is quite good for large- and smaller-bodied habitat generalists within the Custer Gallatin Forest boundaries, and has been well-maintained under existing plan direction. All revised plan alternatives would incorporate desired conditions, goals and guidelines to ensure that habitat connectivity is a consideration for future land management practices. In addition, fine-filter components for individual wildlife species would protect important seasonal habitats and reproductive areas, which would further contribute to habitat connectivity under all revised plan alternatives. Alternatives B, C, and D add fine-filter plan components for key linkage areas to further protect potential wildlife migration areas that have been identified in the scientific literature (Walker and Craighead 1997, Claar et al. 2003, Western Governors' Association 2008, Cushman et al. 2009, Wade et al. 2015), as well as Custer Gallatin connectivity modeling results (see Appendix B for methods) as important for wildlife movement between intact ecosystems.

Consequences to Connectivity from Forest Plan Components Associated with Other Resource Programs or Management Activities

Effects of Aquatic and Riparian Habitat Management

The revised plan alternatives include substantially more detailed and restrictive plan components for watersheds and riparian management zones compared to the current plans. Access to water is crucial for wildlife, and animals on the move are no exception. Wildlife often follow water courses and drainages when moving within home ranges, between seasonal ranges, and even during dispersal movements. Riparian habitats provide important travel corridors for a wide range of terrestrial species, and stronger riparian protections in the revised plan alternatives would serve to better maintain or restore habitat connectivity for wildlife associated with riparian areas, compared to the current plans.

Effects of Terrestrial Vegetation Management

All revised plan alternatives include a suite of plan components for terrestrial vegetation management designed to maintain or restore the ecological integrity of Custer Gallatin National Forest lands. These components include desired conditions for vegetation that fall generally within the natural range of variation, which would result in habitat and landscape patterns similar to those which native species have adapted to over time. The revised plan alternatives incorporate new scientific concepts reflective of more ecological thinking, and include considerably more detail regarding vegetation composition, structure and function with a greater emphasis on providing for ecological integrity and resilience to disturbances under changing environmental conditions, compared to existing plans.

Effects of Fire and Fuels Management

Native wildlife on the Custer Gallatin are typically fire-adapted species. Wildfires are expected to be the most prominent disturbance factor influencing habitat connectivity during the life of the forest plan.

Climate projections predict increases in fire size, frequency and severity relative to fire regimes experienced under existing plans. All revised plan alternatives include desired conditions that wildland fires burn with a range of intensity, severity and frequency that allows ecosystems to function in a resilient and sustainable manner. Management actions for fire and fuels would be focused on reducing risk to high value resources most commonly found in more developed areas, including the wildland urban interface. Therefore, under all alternatives, fire and fuels management actions would be focused in areas of relatively high human modification, which generally have lower habitat connectivity values for wildlife. Simultaneously, the revised plan alternatives recognize that wildland fire is a necessary and crucial ecological factor that plays an important role in shaping habitat for a wide array of wildlife species. To that end, the revised plan alternatives all include an objective for at least 375,000 acres of wildfire per decade on the Custer Gallatin, based on predictions that wildfire-affected acres will at least double compared to what the landscape has experienced under existing plans. Fire and fuels management actions would be designed to move towards the desired ecological conditions, which would generally be within the natural range of variation, resulting in conditions similar to those in which native species have evolved.

Effects of Timber Management

Under all alternatives, the effect of timber management on habitat connectivity would be small relative to effects from natural disturbance processes such as fire, insects or disease, and natural succession of vegetation communities. Regeneration harvest methods that remove all or most live trees, would alter habitat connectivity at a small scale for forest-associated species, but would temporarily improve habitat, and possibly increase habitat connectivity for grass and shrub-associated species, as well as some habitat generalists. Compared to the current plans, maximum opening size, and shape of openings created by timber management under the revised plan alternatives, would be designed to mimic the average size and general shape of natural openings in the surrounding areas. The revised plan alternatives then, would contribute to the desired patch size distribution for forest, grass and shrub habitats, to a greater degree than has occurred under existing plan direction. Under all revised plan alternatives, timber harvest methods such as thinning and intermediate harvest would serve primarily to reduce existing tree density, which could be used to change tree species composition toward desired conditions, or could also be used to increase the average size of individual trees, thus increasing the large tree element in forested landscapes and increasing structural diversity of some forested habitats. Timber management then, could have negative impacts on some species, while benefitting or having neutral effects on others. However, under the revised plan alternatives, the desired conditions for vegetation composition, structure and function, would drive timber management toward achieving conditions within the natural range of variation, to which most native species have adapted.

Effects of Invasive Species Management

Invasive species, whether plant, animal, aquatic, or other organisms, often have potential to substantially outcompete native organisms, which can result in disruption of natural processes. The presence and spread of invasive species can alter vegetative conditions, resulting in habitat fragmentation for native species. The revised plan alternatives all contain desired conditions in which invasive species are absent or in low abundance, with no disruption of natural ecological function on the Custer Gallatin. All revised plan alternatives would formally incorporate new science from more current, proven invasive species management practices, which would improve effectiveness of programs to slow the spread of invasive species. As such, compared to existing plans, the revised plan alternatives would move management strategies toward adopting more current technologies, including updated tools and practices, that would result in a more strategic approach to invasive management for the Custer Gallatin. Finally, similar to existing plans, the revised plan alternatives acknowledge that some non-native species are desirable. For example, mountain goats are not native to the Custer Gallatin, but provide prey species for predators, contribute to nutrient cycling in relatively harsh environments, and provide high-quality hunting and viewing opportunities for forest visitors. All alternatives support the presence of desired non-native species where they do not conflict with native species and contribute to healthy, functioning ecosystems.

Effects of Permitted Livestock Management

All revised plan alternatives include a suite of plan components for permitted livestock grazing that would allow livestock grazing to complement other management tools to move toward desired ecological conditions for vegetation. For example, livestock grazing in certain areas could be used to reduce fine fuels in order to lower fire risk to nearby shrub habitats, or could be used in meadows to reduce noxious weed invasions. The revised plan alternatives all include plan components that would ensure grazing management practices to promote sustainable and resilient native plant communities, with restrictions in place to ensure that grazing does not adversely affect tree regeneration in forested areas, riparian vegetation, streambank stability, or forage availability for native herbivores. All revised plan alternatives incorporate plan components that would reduce impacts in rare shrub habitats such as aspen, woody draws, and riparian areas through proper placement of new livestock grazing infrastructure. In contrast to existing plans, the revised plan alternatives would specifically address wildlife habitat connectivity concerns by requiring new or replacement allotment fences to be strategically located and constructed to minimize collision hazards for wildlife and prevent barriers to wildlife movement, and stock water tanks to include wildlife escape features.

Effects of Infrastructure (Roads and Trails) Management

Forest infrastructure such as roads and trails can result in direct habitat loss at a relatively small scale associated with vegetation removal to create travel surfaces. Disturbance factors associated with human use of travel routes can also influence wildlife habitat use patterns. Human use of Forest roads and trails can result in wildlife mortalities due to vehicle collisions, or hunting. High speed and traffic volume are factors most frequently attributed to road impacts on wildlife movement patterns (Claar et al. 2003). Several studies have concluded that secondary, unpaved roads with lower speed and traffic volume have low impact on large-scale wildlife movement patterns (Forman 2003); however, different wildlife guilds, species and individuals may have widely variable tolerance or avoidance tendencies relative to secondary roads (The Wildlife Society 2014). While some animals may avoid roads and underutilize habitat near roads, others actually use roads and trails to facilitate movement between habitats. Less than one percent of roads within the national forest boundary are paved routes that accommodate higher speeds and traffic volume. Over 90 percent of forest roads are generally narrow (often single track) gravel or dirt surface that accommodate low levels of slow-moving traffic. Roughly half of the secondary roads within the national forest boundary are open to administrative use only; for example are not open to public use.

Under all revised plan alternatives, forestwide plan components include desired conditions for a safe, efficient transportation system that poses minimal impacts on resources such as threatened and endangered species. The revised plan alternatives include forestwide plan components that place restrictions on road construction and administrative facilities in old growth forest and riparian areas, encourage use of technologies that reduce impacts to other resources, and facilitate removal and restoration of roads and facilities no longer needed. All revised plan alternatives contain objectives for removal of unneeded system roads, most of which occur in the pine savanna ecosystem. The emphasis on forestwide plan components for infrastructure management is to protect water and riparian resources, which are important connecting habitats for wildlife. Forestwide plan components for infrastructure do not vary by alternative, therefore, effects to habitat connectivity outside of key linkage areas would be the same under all revised plan alternatives. However, these components provide more detailed guidance, and more restrictions on construction of new roads and other facilities, than currently contained in existing plans, so the revised plan alternatives would provide overall better protection for habitat connectivity; particularly riparian habitats that provide potential travel corridors for a wide variety of wildlife species.

Cumulative Effects

Very few land management plans for areas in the vicinity of the Custer Gallatin National Forest include direction specific to maintaining or restoring habitat connectivity across larger landscapes. However, in the montane ecosystem geographic areas, where genetic isolation of species has been cited as a stressor on individual populations and metapopulations (Haroldson et al. 2010, Adams and Dood 2011, Proctor et al. 2012, Garrott et al. 2015), the Custer Gallatin is bordered on the south by Yellowstone National Park, which largely managed for conservation of natural resources. The Beaverhead-Deerlodge and Shoshone National Forest portions adjacent to the Custer Gallatin are largely in designated wilderness areas, which provide a high degree of protection for wildlife habitat connectivity. National Forests to the north of the Custer Gallatin are in the process of amending forest plans to adopt direction consistent with the Northern Continental Divide Ecosystem Grizzly Bear Conservation Strategy, which includes consideration for habitat connectivity between the Northern Continental Divide Ecosystem and Greater Yellowstone Ecosystem for wide-ranging species. State Wildlife Action Plans for both Montana and South Dakota address the importance of habitat connectivity for conserving healthy, resilient wildlife populations.

Conclusion

All revised plan alternatives specifically address habitat connectivity, and state the desire to maintain habitat connectivity for wildlife across the Custer Gallatin, as well as the broader landscape. The revised plan alternatives include goals to work with other agencies, landowners, and partners across jurisdictional boundaries to achieve habitat connectivity at a scale much larger than the Custer Gallatin Forest. In summary, while the existing plans contain direction to protect important elements of wildlife habitat, which collectively contribute to habitat connectivity, the revised plan alternatives contain a more holistic, integrated and ecological approach that would more effectively address the larger scale issues associated with wildlife habitat connectivity.

Alternatives contain different combinations of land allocations. Alternatives B, C, and D contain more restrictive land allocations and introduce plan components that specifically address key linkage areas, which would limit permanent habitat alterations to a greater degree than alternatives A or E. All revised plan alternatives provide for connectivity within the national forest boundary, while alternatives B, C and D also provide for connectivity between key areas of national forest land. Alternative D contains the largest amount of recommended wilderness, which would result in the lowest human habitat modification and disturbance as a contribution to habitat connectivity. However, alternatives B and C would also reduce human disturbance factors compared to alternatives A and E, but would allow greater management flexibility and a wider range of tools to both maintain and restore habitat connectivity compared to alternative D.

3.11 General Contributions to Society and Economic Sustainability

3.11.1 Introduction

The mission of the Forest Service is to sustain the health, diversity, and productivity of the United States' forests and grasslands to meet the needs of present and future generations. The Custer Gallatin National Forest lands both influence, and are influenced by, local and national publics. Local communities, particularly those adjacent to national forest lands, benefit from a multitude of goods and services provided by the Custer Gallatin and the Forest Service. These social benefits are often referred to as ecosystem services, which are defined "as goods and services provided wholly or in part by ecosystems and that are of value to people" (Olander et al. 2015). The Custer Gallatin's ecosystem services, alongside infrastructure and operations, are the main ways that public lands contribute to social and economic sustainability. Many local communities were formed based on availability of roads and ecosystem goods and services such as timber, minerals, grazing lands, and other natural resources. Historically, individuals in these communities have benefited from a host of services such as recreation, scenery, employment and opportunities to connect with nature. The general public across the U.S. also benefit from the Custer Gallatin National Forest (forest). The key benefits the Custer Gallatin and the Forest Service provide include clean air, clean water and aquatic ecosystems, conservation of ecosystems (lands, rare plants, and species for fishing, hunting, and wildlife viewing), specially designated areas, educational and volunteer programs, employee service to communities, fire and fuels management, flood control, infrastructure, forest products (including timber, firewood, Christmas trees, berries, mushrooms), income (payments in lieu of taxes, secure rural schools, induced income, including recreation, timber, grazing, etc.), inspiration (including spiritual inspiration), jobs (and induced jobs, including recreation, timber, grazing, etc.), mineral and energy resources, preservation of historic, cultural, tribal or archeological sites and caves, grazing, scenery and recreation.

The 2012 Planning Rule states that plans are to guide management so that forests and grasslands contribute to social and economic sustainability, providing communities with ecosystem services and multiple uses that deliver a range of social, economic, and ecological benefits in the present and into the future. Specifically, plan components must include standards or guidelines to guide the Custer Gallatin's contribution to social and economic sustainability. This takes into account ecosystem services as well as multiple uses that contribute to local, regional, and national economies and communities in a sustainable manner. Furthermore, reasonably foreseeable risks to social benefits shall be considered when developing the forest plan.

This section, therefore, describes the social and economic conditions of the affected environment using key indicators of social and economic sustainability; describes how key benefits of the Custer Gallatin currently contribute to social and economic sustainability of beneficiaries, both locally and at a broader scale; and evaluates the impacts of the proposed forest plan and alternatives on the benefits the national forest provides to local beneficiaries and the general public.

Regulatory Framework

The following is a select set of statutory authorities that govern the evaluation of social and economic resources in the Custer Gallatin National Forest. They are briefly identified/described below to provide context to the management and evaluation of the resource. There are multiple other laws and regulations and policies not described below that also guide the management of this resource.

2012 National Forest System Land Management Planning Rule: makes evaluations of social and economic resources are framed within the context of sustainability because, in accordance with the 2012 National Forest System Land Management Planning Rule (36 CFR 219), forest plans are to guide management so that forests and grasslands are ecologically sustainable and contribute to social and economic sustainability. The agency 2012 planning process leads to plans that contribute to ecological, social, and economic sustainability by protecting resources on the unit to maintain a flow of goods and services from National Forest System lands on the unit over time.

Portions of the 2012 Planning Rule that specifically relate to social and economic resources include: "contribute to ecological, social, and economic sustainability by ensuring that all plans will be responsive and can adapt to issues such as the challenges of climate change; the need for forest restoration and conservation, watershed protection, and species conservation; and the sustainable use of public lands to support vibrant communities." "Social sustainability" refers to the capability of society to support the network of relationships, traditions, culture, and activities that connect people to the land and to one another and support vibrant communities. "Economic sustainability" refers to the capability of society to produce and consume or otherwise benefit from goods and services including contributions to jobs and market and nonmarket benefits (36 CFR 219.19) section 219.8. The plan must provide for social, economic, and ecological sustainability within Forest Service authority and consistent with the inherent capability of the national forest, as follows:

> Social and economic sustainability (36 CFR 219.8(b)). The plan must include plan components, including standards or guidelines, to guide the forest's contribution to social and economic sustainability, taking into account:
>
> 1. Social, cultural, and economic conditions relevant to the area influenced by the plan;
> 2. Sustainable recreation; including recreation settings, opportunities, and access; and scenic character;
> 3. Multiple uses that contribute to local, regional, and national economies in a sustainable manner;
> 4. Ecosystem services;
> 5. Cultural and historic resources and uses; and
> 6. Opportunities to connect people with nature (36 CFR 219.8).
>
> Reasonably foreseeable risks to ecological, social, and economic sustainability (36 CFR 219.10 (a)).

The rule states that the plan must also be consistent with laws and executive orders including:

Multiple-Use Sustained Yield Act of 1960: identifies principles for managing the resources of the National Forest System. The direction to manage these resources for the greatest good over time includes the use of economic and social analysis to determine management of the National Forest System.

National Environmental Policy Act of 1969: mandates consideration of the consequences to the quality of the human environment from proposed management actions. The agency must examine the potential impacts to physical and biological resources as well as potential socioeconomic impacts (40 CFR 1508.14).

Forest and Rangeland Renewable Resources Planning Act of 1974 (as amended by the National Forest Management Act of 1976): requires consideration of potential economic consequences of land management planning.

Office of Management and Budget Circular A-116 (issued August 16, 1978): requires executive branch agencies to conduct long range planning and impact analysis associated with major initiatives.

Executive Order No. 12898 on Environmental Justice (issued February 11, 1994): mandates Federal agencies to make achieving environmental justice part of their mission. This includes identification and response to disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.

National Forest Revenue Act (amended 1908): requires 25 percent of revenues generated by National Forest System lands to be paid to the states for use by the counties in which the lands are situated for the benefit of public schools and roads.

Secure Rural Schools and Community Self-Determination Act of 2000: designed to stabilize annual payments to state and counties containing National Forest System lands and public domain lands managed by the Bureau of Land Management. Funds distributed under the provisions of this act are for the benefit of public schools, roads, and related purposes.

Key Indicators and Measures

Social Conditions

The social conditions of the area of influence are assessed using the following demographic indicators:

- population size
- population change(2000-2010) and projected change (2010-2030)
- urbanization trend (percent change in ratio of urban to rural households 2000-2010)
- elderly composition(percent of population aged 62 and older)
- low income population (percent of population below poverty line) - environmental justice indicator
- minority population (percent of non-Hispanic white population) - environmental justice indicator

Environmental Justice

Social conditions indicators are also used to identify environmental justice populations within the social area of analysis. These populations are defined as Census County Divisions (a proxy for communities) with a poverty rate over 20 percent or a minority population of 20 percent or greater (Periman and Grinspoon 2014). The process for identifying environmental justice communities within the social area of influence is described in detail in the Title of Specific Assessment Report (citation).

Economic Conditions

The indicators used to assess economic sustainability are the contributions of direct, indirect, and induced jobs and income, as well as direct Federal land payments made to local governments. National Forest System administration and national forest assets, including natural resources as well as many other ecosystems goods and services contribute to the economic sustainability within the area of influence.

Within the concept of quality of life are economic opportunities to obtain income and employment. For the purposes of this analysis, economic factors of quality of life will be discussed separately of others labeled as social benefits.

The key economic benefits of the Custer Gallatin include reliable contributions to jobs and income, directly and indirectly. These benefits, as well as other social benefits were identified through interdisciplinary discussions with forest staff and comments from the public. Key economic benefits to society provided by the Custer Gallatin include:

- Income (direct, indirect and induced income from multiple uses of national forest assets).
- Jobs (direct, indirect and induced jobs, including those related to providing recreation experiences, harvesting and process timber into forest products, grazing and the raising of livestock, mineral, oil and gas resources for energy and raw material productions, and other types of jobs.)

Social Benefits

The indicators used to assess contributions to social sustainability are the key social benefits the Custer Gallatin National Forest provides to beneficiaries, explored in the context of social conditions. These social benefits contribute to the social sustainability of the area of influence (that is, affected communities and beneficiaries) by enhancing the quality of life of the public. Quality of life is defined as the general level of wellbeing of individuals and society. The concept of quality of life encompasses all aspects of life including employment, safety and health. For the purposes of this analysis, however, income, jobs, health, safety, and well-being are often discussed separately to emphasize the specific ways the Custer Gallatin enhances quality of life.

The key social benefits of the Custer Gallatin include ecosystem services, multiple uses, infrastructure and contributions from management operations such as educational programs and fire suppression. Key benefits were identified through interdisciplinary discussions with national forest staff and comments from the public. Key benefits to society provided by the Custer Gallatin include:

- Clean air
- Clean water, aquatic ecosystems, and flood control
- Conservation of ecosystems (lands, rare plants, and species for fishing, hunting, and wildlife viewing)
- Designated areas
- Educational and volunteer programs
- Employee service to communities
- Fire suppression and fuels management
- Forest products (including timber, firewood, Christmas trees, berries, mushrooms)
- Grazing

- Income (payments in lieu of taxes, secure rural schools, induced income, including recreation, timber, grazing, etc.)
- Infrastructure
- Inspiration (including spiritual inspiration)
- Jobs (and induced jobs, including recreation, timber, grazing, etc.)
- Mineral and energy resources
- Preservation of historic, cultural, tribal or archeological sites
- Recreation
- Scenery

Methodology and Analysis Process

Social benefits of the Custer Gallatin National Forest are those ecosystem services (including multiple uses), infrastructure, and operations, which either directly or indirectly, contribute to social sustainability; that is they are of value to people. Infrastructure and operations benefits include both physical elements, such as roads and facilities, as well as all the services the Forest staff provide such as fire suppression and educational programs.

Numerous approaches exist for measuring society's condition or progress towards achieving social sustainability. In the forest planning context, a broad ecosystem services framework, which catalogues social benefits of forests, is an ideal framework for identifying how the Forest contributes to social sustainability.

Social benefits of the Custer Gallatin are used and valued differently by different groups and communities. The Social and Economic Conditions Assessment Report (Larson and Rasch 2017) provided a brief overview of social conditions and highlighted the benefits the national forest provides to the affected communities. In the Affected Environment section, the social conditions of affected communities are summarized alongside a discussion of the key social benefits the Custer Gallatin provides to beneficiaries.

A social area of analysis was identified during the assessment phase to analyze the potential effects of the proposed action and alternatives on the Custer Gallatin's contributions to social sustainability. The social area of analysis is defined as all census county subdivisions within 50 miles of the national forest boundaries. The social area of influence is different from the economic analysis area.

The social analysis is conducted in three steps. First, the relevant social conditions of the social area of analysis are summarized. Next, each social benefit is briefly described, and when relevant, discussed in the context of the social conditions of the area of influence. Some social benefits are easier to quantify than others. Indicators that do not easily lend themselves to quantification, such as employee service to communities, are discussed qualitatively. Lastly, the proposed action and alternatives are analyzed to determine how they might affect each social benefit; that is, contribution to social sustainability, taking relevant social conditions, risks and stressors into account. Social benefits addressed in detail in other resource reports are only briefly addressed in this section. This section draws from other resource analysis sections.

The focus of this analysis is determining how the proposed action and alternatives may affect contributions to economic sustainability and to social sustainability or social benefits.

Economic benefits of the Custer Gallatin are those that directly result from economic opportunities provided by national forest assets including National Forest System administration.

Limited approaches exist for measuring conditions and progress towards achieving economic sustainability. In the forest planning context, an economic impact analysis is a useful method to estimate the contribution of jobs and income from agency administration, and the provision of measurable ecosystem goods and services.

The economic area of influence is comprised of 15 counties, an area identified with the most recently available data through methods detailed in the Forest Service Protocols for Delineation of Economic Impact Analysis Areas (METI Corp/Economic Insights of Colorado 2010), and further updated by the Washington Office Memorandum (O'Kray, 2018). The economic area of influence is different from the social analysis area.

Information Sources

Information sources for social conditions and social benefits include a mix of agency databases, public surveys, government planning documents, public meeting notes, public comments, and scientific information. Information sources include county growth policies (comprehensive plan for Harding County), American Community Survey, 2010 to 2014 dataset, United States Census, Economic Profile System– Human Dimensions Toolkit (EPS-HDT), the Northern Region social survey, the public lands survey, public comments and public meeting notes. Scientific literature related to environmental management values and preferences for public land management are also referenced, where relevant. The EPS-HDT data platform harmonizes data from the Bureau of Economic Analysis, the Bureau of Labor Statistics, and the US Census Bureau (Headwaters Economics). Internal databases which contain administrative data on grazing permits, timber contracts, educational programs, partnerships and volunteer program participants were are used in the analysis. The data used in the analysis of the social environment are the best available.

The social analysis would benefit from a systematic collection of data on the values, attitudes and beliefs of affected communities as they relate to forest management and planning decisions. Survey data on the values, attitude and beliefs of the local population within the social area of influence are used in the analysis, which are appropriate for assessing values, attitudes and beliefs at the forest plan scale. However, data are not available at the community level. The public had opportunities to contribute their input throughout the Assessment and planning process by attending public meetings and submitting public comments. There are no data available to measure what proportion of the affected public understood or engaged in the process.

Economic existing conditions data are collected and monitored through the Economic Profile System – Human Dimensions Toolkit (EPS-HDT) (http://headwaterseconomics.org/tools/eps-hdt), a data repository that is updated monthly. The economic and population data accessed through Economic Profile System are sourced from various Federal sources including the U.S. Department of Commerce. Additional economic data is collected from IMPLAN licensed software, an aggregator of regional economic research data for over 500 industries in the United States.

The economic analysis would benefit from economic data at subcounty levels, and from time periods that are more current than existing economic datasets typically are made available. However, these data are not readily available from a public source or consistent across communities.

The social and economic analysis draws upon the best available literature citations that were found to be relevant to the economic and social conditions on the Custer Gallatin. Literature sources that were the most recent, peer-reviewed, and local in scope or directly applicable to the local economic and social environment were selected. Uncertainty and conflicting literature was acknowledged and interpreted when applicable.

Analysis Area

The social area of analysis is defined by both geography and social ties. All Census county divisions within 50 miles of the Custer Gallatin are included. The 50-mile distance threshold is commonly used to approximate areas of social influence as it represents approximately a one-hour's drive to the national forest. This is a reasonable distance for one to travel on a weekly or even daily basis, either for recreation or for commuting purposes. Additionally, the bulk of national forest visits, over 2 million, (approximately 67 percent of total visits) to the Custer Gallatin National Forest, according to 2010-2014 National Visitor Use Monitoring Survey data, were from people living within 50 miles of the national forest.

The social area of influence contains 231 county subdivisions, spanning 46 counties, the majority of Custer Gallatin National Forest lands fall within 11 counties: 10 counties in Montana (Meagher, Madison, Gallatin, Park, Sweet Grass, Stillwater, Carbon, Rosebud, Powder River, Carter) and Harding, South Dakota.

Contributions from the Custer Gallatin to the broader landscape, including national and global stakeholders, are also considered. The scale of the broader landscape is dependent on the given benefit in question. For example, those who benefit from the existence of wilderness, even if they never plan to visit (Kline and Mazzotta 2012), are considered when examining the inspirational benefits of wilderness areas in the Custer Gallatin. For a detailed explanation on the social area of analysis, please refer to the socioeconomic report in Social and Economic Conditions Assessment Report (Larson and Rasch 2017).

There are multiple analysis areas to consider when measuring economic benefits. The broadest of these areas includes 52 counties and encompasses all counties within 50 miles of the national forest boundary. Within these 52 counties exists a more intimate analysis defined in the forest plan assessment. This area is made up of 15 counties, 11 of which receive Federal land payments for having the Custer Gallatin National Forest lands within them (figure 42).

The temporal scope of the analysis is the anticipated life of the plan. The analysis area for indirect effects is the same as the analysis area for cumulative effects.

3.11.2 Affected Environment (Existing Condition)

The affected environment segment is subdivided into four sections: social conditions, environmental justice populations, economic conditions (including contribution to economic sustainability), and social benefits (that is, contributions to social sustainability).

Social Conditions

The key social conditions in the social area of influence are summarized in table 65 by geographic area. The western area are those communities within 50 miles of the Pryor Mountains; Absaroka Beartooth Mountains; Bridger, Bangtail and Crazy Mountains; and Madison, Henrys Lake and Gallatin Mountains geographic areas. The eastern area are those communities within 50 miles of the Sioux and Ashland geographic areas. Under elderly population, high or low indicates some communities in the social area have a higher proportion of elderly and some have a lower proportion of elderly, compared to the state of Montana.

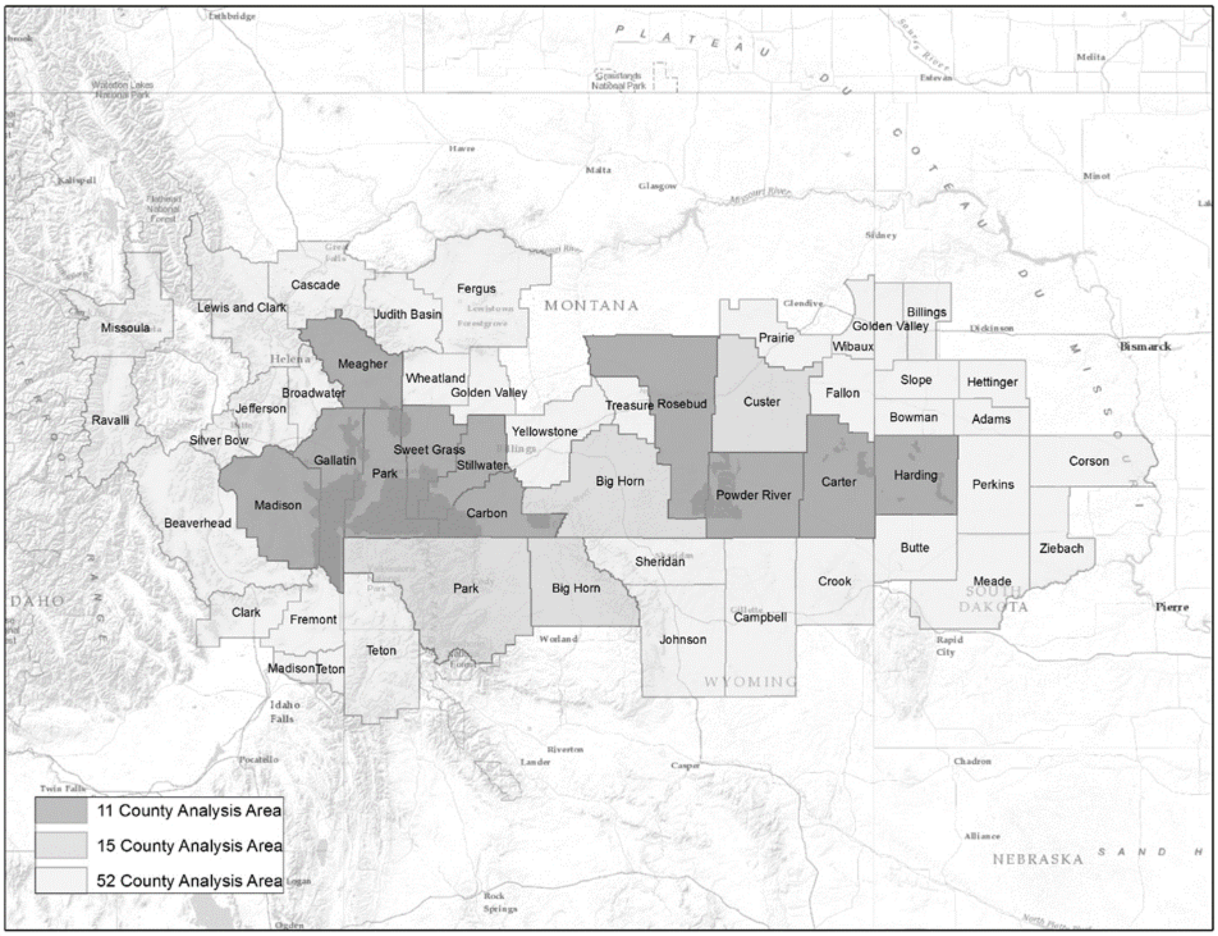

Figure 42. Economic area of influence. Map source: U.S. Forest Service Northern Region 2018

Table 65. Summary of social conditions in the social area of influence

Social Condition	Total social area of analysis	Western communities	Eastern communities
Population size	590,000	Large	Small
Population change (2000-2010)	Increased	Mostly increased	Mostly decreased
Projected population change (2010-2030)	Increase	Increase	Increase
Urbanization (2000-2010)	No change	Increased	Decreased
Elderly population	High/low	High/low	High/low
Low income population	Yes	Yes	Yes
Minority population	Yes	Yes	Yes

Many communities around the Custer Gallatin National Forest are growing, and are projected to continue to grow in the coming decades. There continues to be a high demand for both urban and rural lifestyles. Although populations are increasing in urban areas, they are also increasing in rural areas, suggesting that increasing demand for forest benefits such as recreation and grazing will continue into the coming decades. While the social area of influence has a similar proportion of elderly communities, compared to the state averages, there are also higher concentrations of older populations in some communities close to forest boundaries. This suggests the presence of populations that hold more traditional, utilitarian values around forest resources and more demand for developed recreation opportunities, which older populations can access more easily. There are also many younger, urban communities around the Custer Gallatin, which are more likely to hold distanced, preservationist values and prefer less developed recreation (Cordell et al. 2005, Bowker et al. 2006, Bowker et al. 2012, Rasch 2018). Given the diversity of communities in the social area of influence, forest managers need to balance a broad range of values and interests.

Environmental Justice Populations

Environmental justice populations exist in the social area of analysis and are defined as Census County Divisions (a proxy for communities) with a poverty rate over 20 percent and/or a minority population of 20 percent or greater. Figure 43 shows the distribution of environmental justice populations across the social area of influence.

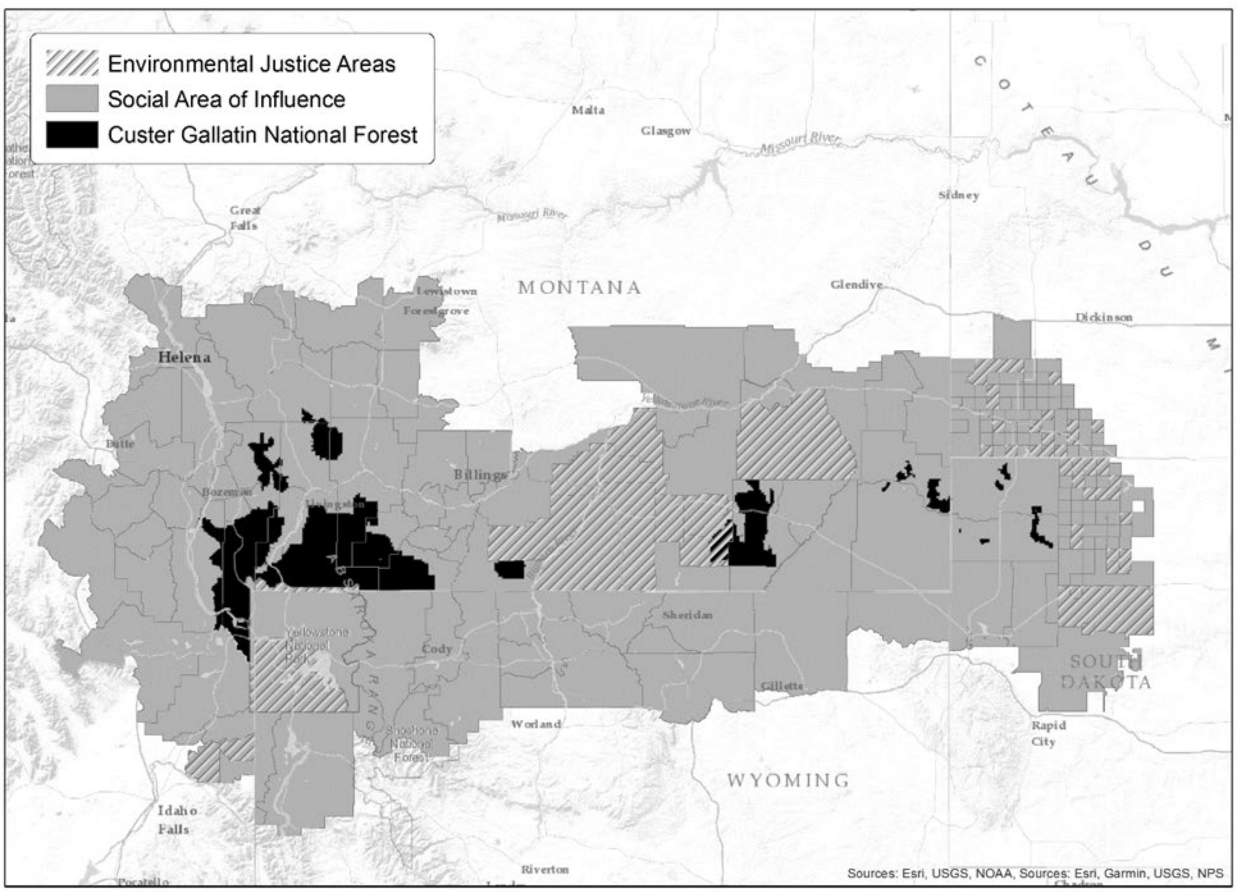

Figure 43. Environmental justice communities in the social area of influence. Data Source: U.S. Census 2015; Map source: U.S. Forest Service Northern Region 2016

The bulk of the environmental justice populations are located on the eastern side of the Custer Gallatin. Two exceptions are Tetonia and East Madison, located in Idaho southwest of the Custer Gallatin, which have high rates of minority and poverty population, respectively. The Crow Reservation and the Northern Cheyenne Reservation are of particular concern, given the high levels of both poor and minority populations in those communities.

Economic Conditions

The area of influence described in this section is comprised of up to 52 counties, an area identified with the most recently available data through methods detailed in the USDA Forest Service Protocols for Delineation of Economic Impact Analysis Areas (METI Corp/Economic Insights of Colorado 2010).

The Social and Economic Conditions Assessment Report (Larson and Rasch, 2017) provided details on the economic characteristics and trends of 15 of these counties including: sector and industry presence (jobs), employment (unemployment rate), income (labor and non-labor), and economic diversification (Shannon-Weaver index). The data in the assessment were reviewed to determine which economic conditions may be relevant for analyzing the effects of the alternatives on economic sustainability. With this lens in mind, the affected environment section provides a more focused summation of the economic conditions in the analysis area. Relevant economic conditions, specifically income, and subsequent jobs in industries closely tied to Federal lands, recreation, and natural resources are of key interest.

Total population, employment and personal income trends since 1970 fluctuate widely across the area of influence counties. Table 66 shows the 52 counties ordered by largest population. Population change since 1970 ranges from 375 percent to negative 48 percent, a measurement for Teton County, Wyoming and Slope County, North Dakota, respectively. Employment change since 1970 ranges from 820 percent to negative 24 percent, a measurement again for Teton and Slope counties, respectively. Lastly, personal income change since 1970 ranges from 2,335 percent to 2 percent, a measurement for Teton County, Wyoming and Powder River County in Montana, respectively.

Table 66. County population, employment and personal income trends 1970-2016 in multi-county area

County	Population 2016	Population Rank	Population % change, 1970-2016	Employment % change, 1970-2016	Personal Income % change 1970-2016
Adams County, ND	2,305	37	-39%	-2%	16%
Beaverhead County, MT	9,401	24	15%	90%	118%
Big Horn County, MT	13,343	14	33%	55%	103%
Big Horn County, WY	12,005	16	17%	49%	99%
Billings County, ND	934	48	-21%	45%	190%
Bowman County, ND	3,241	32	-17%	44%	103%
Broadwater County, MT	5,747	29	126%	139%	318%
Butte County, SD	10,205	22	31%	50%	106%
Campbell County, SD	1,378	43	-52%	-21%	4%
Carbon County, MT*	10,460	21	48%	105%	198%
Carter County, MT*	1,203	45	-38%	-11%	29%
Cascade County, MT	81,755	4	-1%	35%	60%
Clark County, ID	860	49	14%	30%	-25%

County	Population 2016	Population Rank	Population % change, 1970-2016	Employment % change, 1970-2016	Personal Income % change 1970-2016
Corson County, SD	4,132	30	-18%	-13%	24%
Crook County, WY	7,464	28	65%	118%	207%
Custer County, MT	11,924	17	-2%	41%	64%
Fallon County, MT	3,120	33	-23%	38%	63%
Fergus County, MT	11,413	19	-10%	32%	54%
Fremont County, ID	12,943	15	48%	61%	163%
Gallatin County, MT*	104,502	3	219%	511%	664%
Golden Valley County, MT	831	50	-8%	20%	95%
Golden Valley County, ND	1,817	41	-31%	20%	64%
Harding County, SD*	1,278	44	-32%	9%	27%
Hettinger County, ND	2,629	36	-48%	-12%	24%
Jefferson County, MT	11,853	18	124%	177%	412%
Johnson County, WY	8,486	26	51%	131%	193%
Judith Basin County, MT	1,940	39	-27%	-3%	39%
Lewis and Clark County, MT	67,282	5	101%	179%	228%
Madison County, ID	39,048	7	187%	343%	344%
Madison County, MT*	7,924	27	57%	195%	315%
Meade County, SD	27,693	11	61%	160%	165%
Meagher County, MT*	1,827	40	-14%	23%	70%
Missoula County, MT	116,130	2	99%	226%	297%
Park County, MT*	16,114	13	42%	117%	210%
Park County, WY	29,353	10	65%	145%	245%
Perkins County, SD	2,983	34	-37%	-11%	9%
Powder River County, MT*	1,746	42	-38%	-7%	2%
Prairie County, MT	1,182	46	-33%	-18%	31%
Ravalli County, MT	42,088	6	189%	330%	472%
Rosebud County, MT*	9,287	25	54%	111%	193%
Sheridan County, WY	30,200	9	69%	145%	212%
Silver Bow County, MT	34,553	8	-18%	29%	75%
Slope County, ND	763	51	-48%	-24%	27%
Stillwater County, MT*	9,406	23	101%	177%	270%
Sweet Grass County, MT*	3,623	31	22%	105%	139%
Teton County, ID	10,960	20	365%	489%	681%
Teton County, WY	23,191	12	375%	820%	2335%
Treasure County, MT	692	52	-36%	-21%	16%
Wheatland County, MT	2,117	38	-15%	-11%	23%
Wibaux County, MT	1,093	47	-25%	11%	35%
Yellowstone County, MT	158,437	1	80%	172%	251%
Ziebach County, SD	2,801	35	27%	9%	51%
County Region	*977,662*	*N/A*	*61%*	*147%*	*226%*
U.S.	*323 Million*	*N/A*	*59%*	*112%*	*201%*

*Counties intersecting the Custer Gallatin National Forest Boundary and receiving Federal Land Payments

Unemployment and industry presence also fluctuate greatly across analysis area counties. Table 67 shows the 52 counties ordered by unemployment rate. Unemployment rate ranges from 12.1 percent to 1.8 percent, a measurement for Big Horn County, Montana, and Bowman County, North Dakota, respectively. Timber industry presence in private employment is highest, at 17.5 percent in Broadwater County, Montana. Mining industry presence in private employment is highest, at 82.5 percent in Golden Valley County, Montana. Agriculture industry presence in private employment is highest, at 46.2 percent in Slope County, North Dakota. Lastly, travel and tourism industry presence in private employment is highest, at 50.6 percent in Clark County, Idaho.

Table 67. Unemployment and Industry presence in private employment in primary counties

County	Unemploy ment rate, 2016	Timber % of total private employment	Mining % of total private employment	Agriculture % of total employment	Travel & Tourism % of total private employment
Adams County, ND	2.4%	0.0%	0.0%	21.3%	11.6%
Beaverhead County, MT	3.0%	0.4%	1.3%	10.0%	25.1%
Big Horn County, MT	12.1%	0.0%	25.0%	9.8%	20.0%
Big Horn County, WY	4.1%	0.5%	12.5%	11.4%	14.9%
Billings County, ND	3.0%	0.0%	23.5%	20.8%	38.9%
Bowman County, ND	1.8%	0.0%	4.4%	13.2%	17.6%
Broadwater County, MT	4.6%	17.5%	0.5%	13.2%	26.8%
Butte County, SD	3.5%	2.6%	10.7%	11.3%	20.7%
Campbell County, SD	3.3%	0.0%	0.0%	26.7%	11.1%
Carbon County, MT*	3.6%	0.2%	1.6%	13.8%	45.7%
Carter County, MT*	2.4%	0.0%	0.0%	41.3%	26.5%
Cascade County, MT	3.7%	0.1%	0.1%	2.3%	20.4%
Clark County, ID	2.5%	0.0%	0.0%	21.2%	50.6%
Corson County, SD	3.9%	0.0%	0.0%	22.0%	22.3%
Crook County, WY	3.5%	8.4%	14.4%	12.4%	17.6%
Custer County, MT	3.2%	0.0%	4.1%	6.2%	20.7%
Fallon County, MT	2.7%	0.0%	19.7%	13.1%	9.8%
Fergus County, MT	3.9%	0.4%	0.1%	11.8%	16.8%
Fremont County, ID	2.7%	0.4%	0.2%	14.6%	15.1%
Gallatin County, MT*	2.7%	0.2%	0.4%	1.6%	25.0%
Golden Valley County, MT	4.8%	0.0%	82.4%	32.1%	15.3%
Golden Valley County, ND	2.0%	0.0%	0.0%	17.7%	16.1%
Harding County, SD*	3.1%	0.0%	25.9%	25.0%	11.1%
Hettinger County, ND	1.9%	0.0%	0.0%	28.2%	14.2%
Jefferson County, MT	4.1%	2.1%	13.3%	8.2%	18.7%
Johnson County, WY	4.2%	0.3%	1.9%	7.6%	25.4%
Judith Basin County, MT	3.5%	0.0%	0.5%	32.2%	23.4%
Lewis and Clark County, MT	3.3%	0.2%	0.1%	1.6%	17.9%
Madison County, ID	1.9%	0.3%	0.0%	3.2%	8.2%

County	Unemployment rate, 2016	Timber % of total private employment	Mining % of total private employment	Agriculture % of total employment	Travel & Tourism % of total private employment
Madison County, MT*	3.7%	0.6%	6.2%	10.8%	23.4%
Meade County, SD	3.3%	0.8%	0.1%	7.0%	17.8%
Meagher County, MT*	4.3%	0.7%	2.0%	17.2%	38.9%
Missoula County, MT	3.5%	1.1%	0.1%	0.8%	20.7%
Park County, MT*	4.0%	1.9%	0.1%	6.4%	32.2%
Park County, WY	4.3%	0.6%	2.5%	5.0%	24.2%
Perkins County, SD	2.9%	0.0%	0.0%	19.1%	12.4%
Powder River County, MT*	2.4%	0.0%	14.6%	28.3%	23.0%
Prairie County, MT	3.3%	0.0%	0.0%	27.7%	13.0%
Ravalli County, MT	4.5%	1.7%	0.0%	6.6%	16.7%
Rosebud County, MT*	5.0%	0.0%	16.6%	9.6%	14.7%
Sheridan County, WY	3.9%	0.0%	0.8%	4.1%	25.4%
Silver Bow County, MT	4.1%	0.0%	3.1%	0.6%	23.5%
Slope County, ND	2.0%	0.0%	43.4%	46.2%	10.5%
Stillwater County, MT*	3.9%	0.5%	24.6%	11.6%	11.7%
Sweet Grass County, MT*	3.1%	0.0%	35.8%	13.7%	22.4%
Teton County, ID	2.7%	0.1%	0.0%	8.4%	17.9%
Teton County, WY	3.0%	0.0%	0.0%	0.6%	43.6%
Treasure County, MT	3.9%	0.0%	0.0%	35.8%	9.6%
Wheatland County, MT	4.2%	0.0%	1.5%	19.9%	16.9%
Wibaux County, MT	3.2%	0.0%	11.0%	26.5%	34.6%
Yellowstone County, MT	3.4%	0.2%	0.6%	1.3%	18.6%
Ziebach County, SD	4.8%	0.0%	0.0%	34.1%	45.1%
County Region	*3.5%*	*0.5%*	*1.5%*	*4.2%*	*21.4%*
U.S.	*4.4%*	*0.6%*	*0.5%*	*1.4%*	*15.8%*

*Counties intersecting the Custer Gallatin National Forest Boundary and receiving Federal land payments

For most area of influence counties, private timber industries do not represent a significant employer, or employment base, the exception being Broadwater and Crook Counties, where timber represents over 5 percent of all private employment. Despite also being a relatively small proportion of the total economic benefits contributed by the Custer Gallatin National Forest, and operations, jobs in the timber, minerals and energy, and agriculture sectors are likely more sensitive to potential impacts from forest planning.

Collectively, across the full extent of the economic area of influence, private timber jobs were estimated at 1,748 in 2016. Figure 44 provides a 19-year trend on timber industry employment levels, as observed by the U.S. Census Bureau County Business Patterns (Headwaters Economics 2018). Over this time period, private industry timber jobs in this multi-county region have more than halved, the greatest decline occurring in the saw and paper mill subsector.

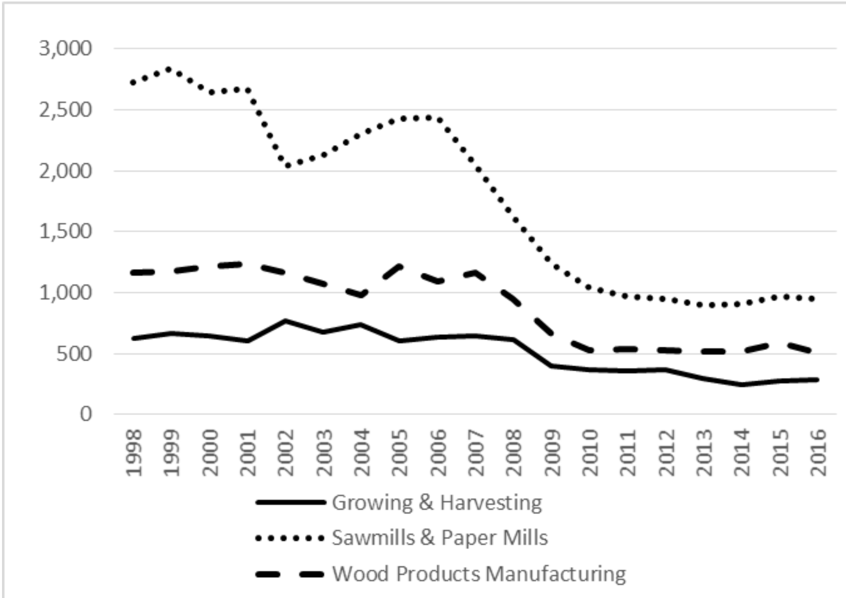

Figure 44. Jobs in timber sectors, 52 county area of influence, 1998 to 2016

The total economic value of the Custer Gallatin National Forest lands and operations, including the contribution of jobs and income to this economic area, involves a great deal more than just sustaining jobs and income in these timber sectors. The following industries, minerals and energy, agriculture and range, and travel and tourism sectors, also directly benefit greatly from this national forest.

Across the full extent of the economic area of influence, private mineral and energy jobs were estimated at 5,514 in 2016. Figure 45 provides the same 19-year trend in mineral and energy industry employment levels, as observed by the U.S. Census Bureau County Business Patterns (Headwaters Economics ETS 2018).

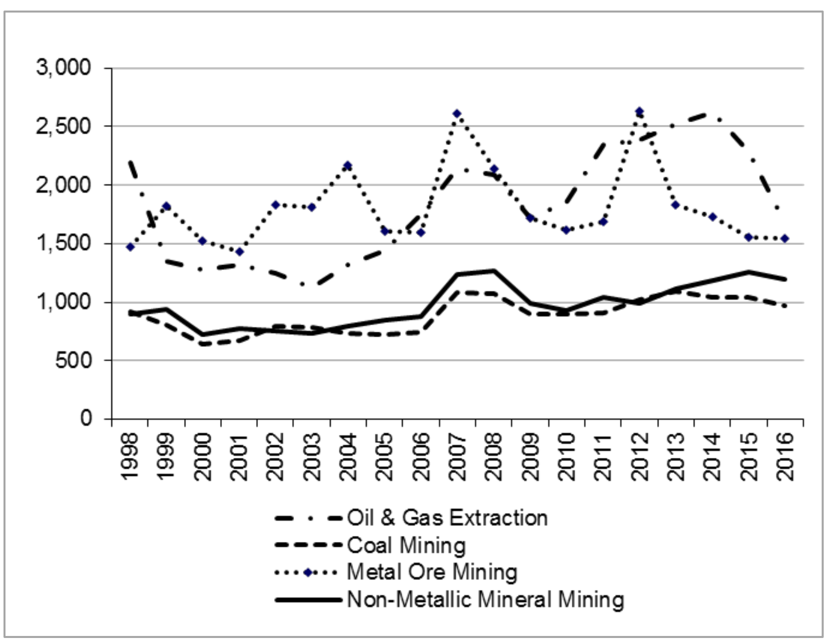

Figure 45. Jobs in mineral and energy sectors, 52 county area of influence, 1998 to 2016

During this time, private industry mineral and energy jobs in this multi-county region have fluctuated with the rise and fall of external market events, and resource discoveries. Levels of employment in this sector have been collectively more stable than in timber sectors across the same region.

In addition to mineral and energy industries, agriculture and grazing industries benefit from the availability of water and rangeland delivered or provided by national forests. Around the Custer Gallatin National Forest, total farm jobs in the area of influence have trended slightly down over a long period of time. From 1970, to 2016, farm jobs in this region have decreased from 33,759, to 27,383. A subset of this large sector includes livestock and range jobs. On a land percentage basis, rangeland is approximately 76 percent of all farmland acres in in this region.

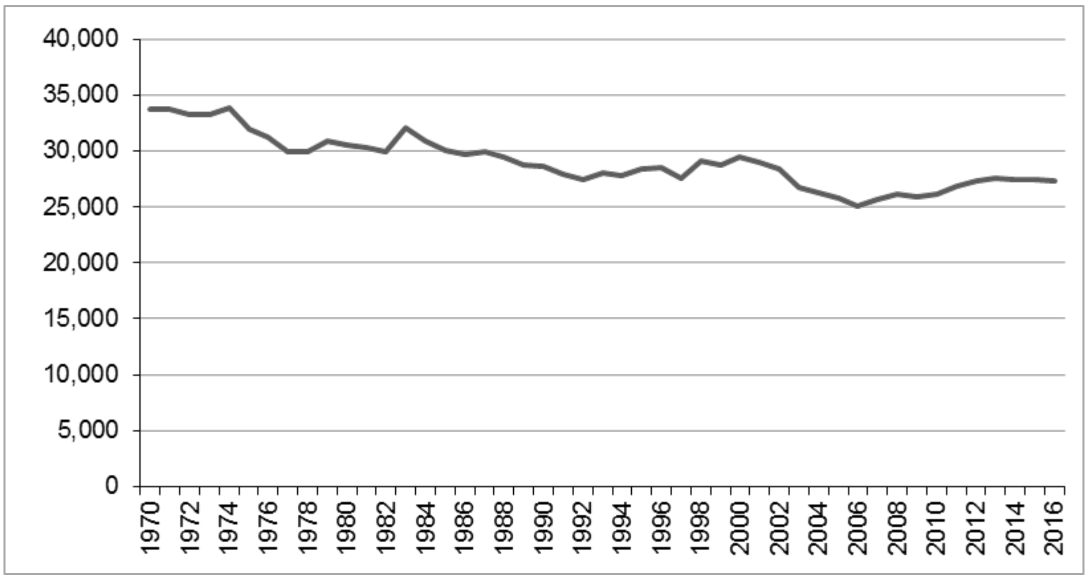

Figure 46. Jobs in farm sectors, 52 county area of influence, 1998 to 2016

Finally, recreation opportunities for local and non-local visitors drives a large part of demand present in the travel and tourism industries across this multi-county region. Collectively, jobs in these subsectors are shifting and on the rise. Since 1998, jobs in retail, arts and entertainment, and accommodations and food service have been on the rise, collectively, from 56,000 to 76,000 in 2016.

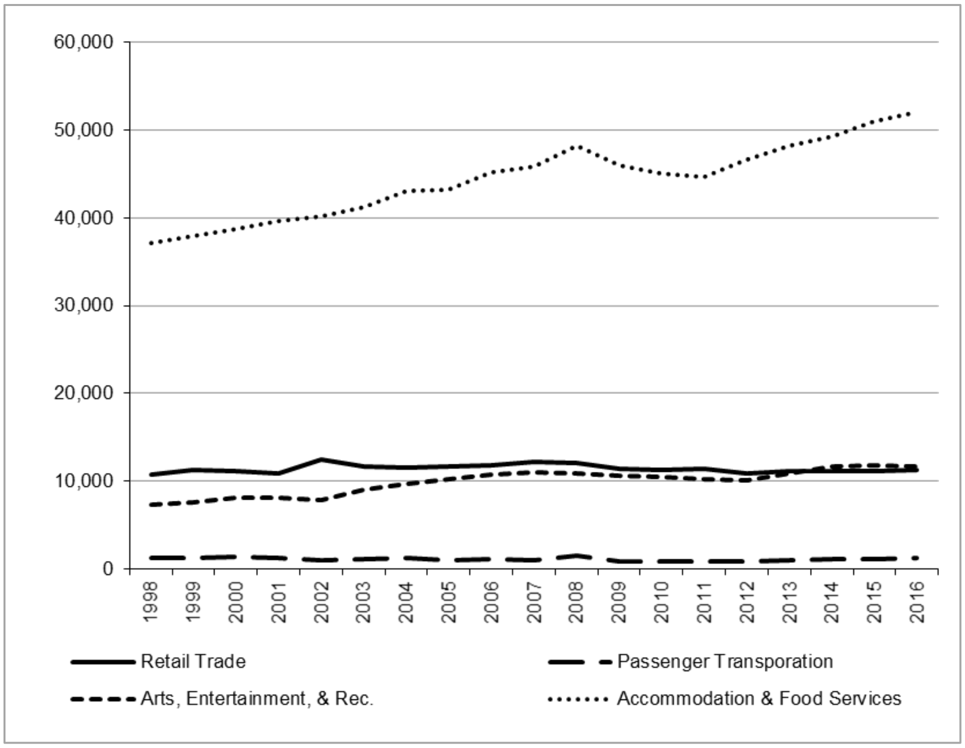

Figure 47. Jobs in travel and tourism related sectors, 52 county areas of Influence, 1998 to 2016

Social Benefits

The key benefits of the Custer Gallatin that contribute to social sustainability by enhancing quality of life are described in detail in the Social and Economic Conditions Assessment Report (Larson and Rasch 2017). These include relevant benefits of multiple uses, ecosystem services, infrastructure, and operations. Below is a brief summary of the social benefits. The discussion of each benefit includes (where applicable and where data allow) a brief description of the benefit, relevant social conditions, local stakeholder values, attitudes and beliefs that relate to the given benefit, and risks and stressors (broader landscape, climate change, conflicting benefits, etc.) that may affect how the benefit is contributing to social sustainability. Only key benefits that have the potential to impact social conditions and have the potential to be influenced by Custer Gallatin National Forest management actions are addressed in detail. Local stakeholder values, attitudes and beliefs are largely identified from the results of the Northern Region Social Survey, public comments, and public meeting notes. Percentages of survey data displayed are weighted responses and representative of the local social area of influence, within + or - five percentage points Bureau of Business and Economic Research (2018). Stakeholders across the social landscape hold diverse values and preferences for management. A majority of local survey respondents share a common vision for the most important purposes of their local, Federal public lands. These include protecting air and water quality, providing wildlife habitat, scenic beauty, preserved wildlands, and recreational opportunities. Figure 48 shows the level of importance local survey respondents assigned to various purposes of local, Federal public lands. The percentages noted in the chart are weighted percentages of local stakeholder survey respondents who feel the given purpose is very or extremely important. It is important to note that grazing was not listed as an answer choice, but was added in as a very important purpose by approximately 12 percent of survey respondents.

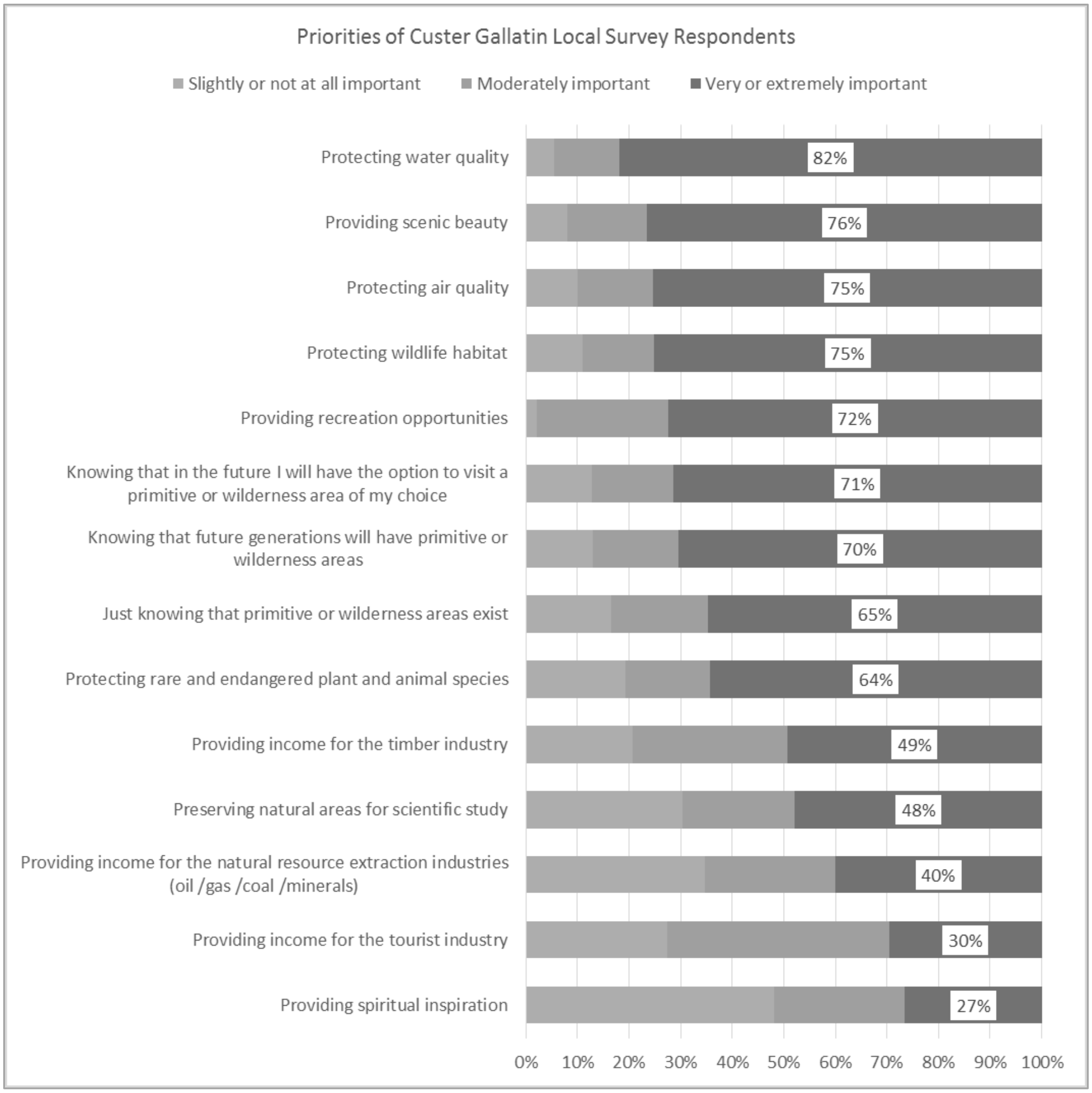

Figure 48. Local stakeholder survey respondent perspectives on the purpose of local Federal public lands

A review of comments from public meetings by location shows that, across the landscape, community participants have differing concerns. Public meetings varied in number of participants. Smaller communities such as Colstrip and Broadus had fewer participants, compared to larger communities, such as Bozeman.) Figure 49 highlights this variation by mapping the level of similarity of topics discussed across community meetings and during the Custer Gallatin Working Group (CGWG) meetings. It is important to note that the CGWG meeting has a preset agenda and topics are identified beforehand. Communities with dots of the same color and closer together on the diagram had more similar discussions. Interestingly, while there was some clustering by geography, that is, communities closer together in space had similar discussions (for example, Buffalo and Ekalaka), there was also a fair amount of diversity across eastern and western communities. For example, discussions and concerns brought forth in the Big Sky meetings were more similar to those at meetings in Columbus, rather than Bozeman, a closer geographic neighbor. Key concerns expressed by Colstrip community members were unique and did not overlap much with other communities. These findings suggest that there are likely diverse concerns and preferences for management of local landscapes.

Figure 49. Correlation of word similarity of discussions at public meetings across the social area of influence

Clean Air

Air quality promotes and nurtures human health. Clean air is also important for maintaining healthy plants, animals, soils, and water bodies (which are sources of drinking water). Air quality, in the short term, impacts from wildland fire smoke can have immediate negative consequences for recreation and tourism. Impacting smoke can be local or long-distance in nature. Duration of poor air quality in the long term can negatively affect water bodies which can lead to degradation of drinking water, increase algal blooms, and decrease in native fisheries. Poor air quality can also negatively impact terrestrial ecosystems leading to the extirpation of rare, sensitive, and native plants and the increase in invasive plants. Decrease in fisheries and increase in algal blooms negatively affect tourism and cost substantial amounts of money and resources to restore.

A large majority (75 percent) of local stakeholder survey respondents identified protecting air quality as a very or extremely important purpose of their local Federal public lands. As populations in counties including Gallatin, Yellowstone, Park (MT), and Madison (MT) continue to grow, existing and new sources of air pollution will flow into surrounding airsheds. In the more rural landscapes of the Custer Gallatin National Forest, this will not likely become as much of an issue. Increasing point and mobile sourced air pollution has the potential triple effect of increasing the value of clean air provided by the Custer Gallatin National Forest, offsetting the appeal of lifestyle and health benefits received from living in the area, and may potentially combine with and increase negative health effects from wildfire smoke. For a detailed analysis of air quality on the Custer Gallatin, refer to the air quality analysis.

Clean Water, Aquatic Ecosystems and Flood Control

Aquatic ecosystems on the Custer Gallatin National Forest support a variety of direct human uses. Among these are angling, municipal and residential water supply, and agricultural uses (stock water, irrigation). In addition, these ecosystems provide a variety of additional benefits, such as flow modulation (buffering both flood and base flows) and scenery. In addition to the nationally and internationally known fisheries, the Custer Gallatin National Forest supports diverse locally and regionally important angling opportunities. Among these are high mountain lakes, where species like golden trout, lake trout, and Arctic grayling are targeted species for some anglers and prairie reservoirs, where largemouth and smallmouth bass, panfish, and put-and-take rainbow trout are targeted species. Additionally, the Custer Gallatin National Forest directly provides municipal water to the cities of Red Lodge, West Yellowstone, and Bozeman. Indirectly, streams emanating from the Custer Gallatin assist in supplying water to cities like Billings and Laurel and are the groundwater recharge zone for residential supplies in many places. A less commonly considered benefit of Custer Gallatin National Forest watersheds is flow modulation — essentially, moderating both high and low flows through the function of floodplains and wetlands. Water storage and retention in Custer Gallatin floodplains can both reduce the rate and duration of peak flow response, but also assist in retaining base flows.

Carter, Gallatin, Harding, Madison (MT), Park (MT), Powder River, and Sweet Grass county growth polices all cited maintaining a clean water supply as a priority to ensure the health and safety of county residents. Gallatin, Madison, Park, and Powder River county growth polices all cited flood control as a priority to ensure the health and safety of county residents. The vast majority (87 percent) of local stakeholder respondents identified protecting water quality and ecosystems as a very or extremely important purpose of their local, Federal public lands. Increasing urban populations, particularly in west area communities, are expected to increase demand for clean drinking water from the Custer Gallatin in the coming decades. During public meetings, stakeholders from eastern communities expressed concern over current water supply for livestock. Increasing rural populations in the east area communities are expected to increase demand for water. Climate change will likely lead to increased frequency of wildfire and floods (Halofsky et al. 2018b). These more frequent occurrences may adversely affect flood control and water quality benefits due to increased soil erosion and sediment in rivers and reservoirs. For a detailed analysis of water and aquatic ecosystems, refer to the watershed, aquatic, and riparian ecosystems analysis.

Conservation of Ecosystems (lands, rare plants, and species for fishing, hunting, and wildlife viewing)

Ecosystem integrity, wildlife, and wildlife habitat are highly valued resources on the Custer Gallatin National Forest. The majority (75 percent) of local stakeholder survey respondents identified protecting wildlife habitat as a very or extremely important purpose of their local, Federal public lands. At public meetings, ecosystem integrity and wildlife were the most common topics of discussion, after recreation. Carbon, Carter, Gallatin, Madison (MT), Park (MT), Powder River, and Sweet Grass county growth policies all cite conservation of soils as important to residents and/or their local economies. Park and Sweet Grass counties policies mention managing invasive species as a priority. Carter, Gallatin, Meagher, Harding, Madison, Park, Powder River, and Sweet Grass county growth policies all cite fishing as important to residents and their local economies. Carter, Madison, Meagher Park, Powder River, and Sweet Grass county growth policies all cite hunting as important to residents and their local economies.

For detailed analyses of wildlife habitat and species available for fishing, hunting and wildlife viewing, refer to the wildlife, watershed, aquatic, and riparian ecosystems analyses.

Designated Areas and Land Allocations

Designated areas of the Custer Gallatin National Forest include designated wildlands and rivers such as wilderness areas and wild and scenic rivers, research natural areas for scientific study, and scenic and historic trails and byways. The revised forest plan proposes land allocations for recommended wilderness areas, eligible wild and scenic rivers, backcountry areas, recreation emphasis areas and the Stillwater Complex. While each type of designation is unique and has a different management goal or philosophy, the overarching themes for designated areas are to: protect ecological integrity and biodiversity, provide a range of recreation opportunities, provide the public with opportunities to connect with, be inspired by, and learn from nature and history, and provide scientists with opportunities to study natural processes and impacts of management actions, and recognize the importance of rare palladium and platinum minerals. A majority (70 percent) of local stakeholder survey respondents identified the nonuse values (that is, just knowing they exists or will exist for future generations) of preserved wildlands (such as, designated wilderness areas) as a very or extremely important purpose of their local, Federal public lands. A majority (72 percent) of local stakeholder survey respondents identified recreation opportunities as a very or extremely important purpose of their local, Federal public lands. The majority (76 percent) of local stakeholder survey respondents identified providing scenic beauty as a very or extremely important purpose of their local, Federal public lands. Close to half (48 percent) of local stakeholder survey respondents identified preserving areas for scientific study as a very or extremely important purpose of their local, Federal public lands.

Designated areas on the Custer Gallatin may enhance the quality of life of both visitors and non-visitors in specific ways that are related to the purpose of that designation. For example, designated historic trails provide opportunities to learn about historic and cultural traditions. Wilderness areas offer challenging recreational pursuits and opportunities for solitude. Research natural areas offer scientists the opportunity to contribute to the body of scientific knowledge. Extensive literatures from the fields of public health, environmental sociology, and environmental psychology document the health benefits, (physical, mental, and emotional) of connecting with nature and exposure to pristine landscapes (Association 2013, Zelenski and Nisbet 2014). During public meetings, some local stakeholders expressed frustration with the limits placed on motorized and mechanized recreation, and economic activities in wilderness areas.

Those who never visit a designated area may also obtain benefits from the area. For example, Cordell, Bergstrom, and Bowker (Bowker et al. 2006) find that most Americans are inspired by just knowing a wilderness or primitive area exists, even if they never visit. (Cole 2005) highlights the symbolic value of wilderness areas, which serve as demonstrations of human restraint and humility. Designated areas also enhance quality of life through science. Designated areas, and particularly research natural areas, provide opportunities for scientific discoveries that advance knowledge for the benefit of society. Stakeholders mentioned designated areas as key benefits that enhance quality of life by supporting income and jobs through tourism and supporting community health by providing opportunities to connect with nature and be inspired by wild landscapes (which enhances both physical and emotional health).

In the past decade, visits to designated areas around the country have increased, particularly day visits. This increase in day use of designated areas is expected to continue as urban populations close to designated areas continue to grow (Rasch and Hahn 2018). Designated areas on the Custer Gallatin in close proximity to the growing urbans areas of Bozeman and Billings will likely experience a significant increase in visits in the coming decades. The projected increase in visits to designated areas may compromise those areas' abilities to meet management goals such as maintaining opportunities for solitude, in the case of wilderness. Climate change may also impact the ecological integrity of ecosystems within designated areas. Increases in invasive species and decreases in native species populations may occur, affecting the pristine nature of some designated areas, and thus impacting the contributions of designated areas to the quality of life of the public.

Level of access and permitted uses vary by designated areas and land allocations, and are determined by the laws, regulations, goals and management principles of the given area. Each areas' level of access and the array of opportunities it offers to the public are described in detail in the designated areas and forest plan allocations analyses.

Educational and Volunteer Programs

The Custer Gallatin provides a multitude of educational opportunities and volunteer programs which teach valuable lessons on land stewardship and how to stay safe while connecting with nature. Since 2001, the Custer Gallatin personnel provided at least 30 programs that reached approximately 50,000 members of the public (including forest visitors) (Nature Watch, Interpretation and Conservation Education, 2016). The most frequent programs were about fire, fire prevention and plant and animal conservation. Many of these programs were provided in partnerships with state or local government, schools, and non-profit organizations. The Custer Gallatin also offers a broad array of volunteer programs which provide volunteers with opportunities to connect with nature and learn about conservation. According to data provided in the volunteer database (USDA Forest Service Volunteers and Partners Accomplishment Report, No. FS-1800_AR), since 2011 volunteers have donated over 107,000 hours of service. This is equivalent to almost 60 person-years of service. Recreation management was the most popular volunteer service project, followed by heritage resources. During public meetings, local stakeholders expressed the need for increased educational programs and signs to reduce user conflicts, protect cultural resources and ensure ecological integrity is preserved or enhanced across the national forest.

As populations in the social area of influence increase, particularly in the Gallatin area, there may be increased demand for educational programming. Given the high levels of educational attainment in Bozeman, there may also be an increased supply of professionals willing to volunteer their knowledge and experience to educational programs. The increasing population may also offer more willing volunteers able to participate in recreation management programs, which are already popular programs. Climate change is projected to impact the Custer Gallatin National Forest and surrounding areas. There may be an increasing need for new educational programs focused on climate change impacts and how the public might need to adapt their current behaviors and uses of forest lands. There are also several large landscape conservation initiatives in the Bozeman area. Opportunities to partner with these organizations to create more robust educational programs for the public may be available.

Employee Service to Communities

Employees of the Custer Gallatin National Forest play active roles in their communities, volunteering their time to enhancing well-being, health and safety, and cultural opportunities in local communities. In a short survey of forest leadership, employees listed a host of organizations and activities they, or their employees, volunteer their time to serve. These include (but are not limited to) youth mentoring, Eagle Mount, Montana Outdoor Science School, food banks, treating weeds on private lands, school volunteers, soup kitchens, firefighting, county search and rescue, blood drives, toastmasters, emergency medical technicians, hospital boards, boy and girl scouts, churches, coaches, music groups, community fundraising, stream clean-up, big brothers and big sisters, and speech and debate judging. Communities benefit from the service of Custer Gallatin National Forest employees. Small communities, with declining populations, such as those on the eastern side of the Custer Gallatin National Forest, may be particularly reliant on national forest employees to hold service roles in their communities.

Fire and Fuels Management

The Custer Gallatin manages both fire suppression and mitigation programs. Fire management and prevention as well as fuels treatment efforts contribute to the safety and well-being of the public by reducing the risk of larger, catastrophic wildfire in the future and protecting communities at risk. Wildfires impact the public through risk to life and property. Even when fires do not directly impact communities, residents may still experience emotional distress from the stress associated with their perceived risk to life and property (U.S. Department of Agriculture and Station 2007). The health of the public is also affected when wildfire smoke reaches unhealthy levels.

At public meetings, some stakeholders mentioned the need to increase fire mitigation measures (for example, fuels management through prescribed fire and pre-commercial thinning) to keep people and property safe from the impacts of wildfire. Some were particularly concerned with fuels management in the wildland urban interface and expressed interest in increased, active management in the wildland urban interface to reduce the risk of wildfire damage to their communities. A majority of local stakeholder survey respondents (68 percent) support using prescribed fire to maintain forest health and reduce wildfire risk in wildland urban interface communities. Approximately half (51 percent) of local stakeholder survey respondents support allowing natural wildfires to burn if they do not threaten people's lives and property. A slight majority (57 percent) of local stakeholder survey respondents support using forest thinning to maintain forest health and reduce wildfire risk in wildland urban interface communities. Approximately half (51 percent) of local stakeholder survey respondents feel that the current level of wildfire mitigation activities conducted on the Custer Gallatin is insufficient, while 28 percent feel the current level of activities is sufficient. For more details, please refer to the fire and fuels analysis.

Forest Products (including timber, firewood, Christmas trees, berries, mushrooms)

Trends from past and potential future timber products shows a decrease in timber outputs. Timber harvest and construction of the needed roads to access harvest areas is challenged by segments of the public at both the local and national level, with concerns primarily focused on endangered species (such as grizzly bear and lynx) and other wildlife habitat needs. Timber harvest is a tool that is used to achieve other resource objectives, beyond providing a commercial forest product. Reduced opportunities to use timber harvest will limit the ability to change vegetation structure, species compositions, landscape patterns, and other conditions for the purpose of improving forest resilience, creating desired wildlife habitat conditions, reducing forest fuels, or other purposes. Carter, Harding, Madison, Meagher, Powder

River, Park (MT), and Sweet Grass county growth polices all cited timber as important to their local economies. The growing populations around the west side of forest may increase demand for forest products such as firewood, Christmas trees, berries, and mushrooms. Approximately half (51 percent) of local stakeholder survey respondents cited income for the timber industry as a very or extremely important purpose of their local, Federal public lands. For more details, please see the timber and special forest and botanical products analyses.

Permitted Livestock Grazing

Grazing opportunities and forage for livestock are available across the Custer Gallatin National Forest. Stakeholders in east area communities expressed concern about grazing opportunities on the Custer Gallatin. Key concerns included management of weeds, conflicts with recreational users and hunters, and lack of available water supply for livestock. Carbon, Carter, Madison, Meagher, Gallatin, Park (MT), Powder River, and Sweet Grass county growth polices in Montana and the Harding County, South Dakota County Comprehensive Plan all cited grazing as important to their local economies. Expected population growth across the social area of influence may lead to added pressure to develop open spaces, further limiting grazing opportunities on non-Federal lands and increasing the importance of Federal lands in maintaining a thriving agricultural industry. The 2016 Rural Montana survey (Muste 2016) data showed that 23.3 percent of respondents thought Federal lands should be managed to increase economic development from farming and ranching. For more information, refer to the permitted livestock grazing analysis.

Infrastructure

Communities and businesses in and near the Custer Gallatin National Forest rely on utility corridors (energy, fiber optic) and communication sites (cellular, radio, emergency response, etc.). These services contribute to quality of life and community sustainability, providing rural communities the ability to connect in a global or regional economy. Additionally, roads, trails, and forest infrastructure provide for safe and reliable access for recreation, resource management, and private inholdings which are tied to community, quality of life, self-identity, economy, and use patterns. Public use on National Forest System lands is increasing as is the population of Montana, specifically in Billings and Bozeman, two of the larger cities in Montana. There is a greater demand for services as well as greater degradation of the road system from the increased use. This trend is expected to continue. There will continue to be a need to provide access for multiple uses including mining, timber, grazing, and recreation. The infrastructure is important for the quality of life for those visiting the Custer Gallatin National Forest. Maintaining and expanding the infrastructure to meet the needs of the national forest users is important to the local economies and quality of life for those living in surrounding communities. Almost all county growth plans highlight the need for maintenance and improvement of existing infrastructure.

Inspiration

Visitors and the general public are inspired by the existence of wildlands, pristine ecosystems, iconic scenery, the wildlife, and rare and unique species that reside in the Custer Gallatin National Forest. These inspirational benefits of nature are well documented in the social science and public health literatures. Inspiration benefits enhance quality of life by inducing awe, joy, and providing stress relief, even to those who never actually visit the national forest. Additionally, a segment of the public feels that spiritual inspiration is a very importance purpose of Federal public lands. Thirty-two percent of local stakeholder respondents noted spiritual inspiration as a very or extremely important purpose of their local, Federal public lands. For more detail on areas of the Custer Gallatin, and opportunities provided by the national forest, which provide inspirational benefits, please refer to the designated areas, forest plan allocations, scenery, and recreation analyses.

Mineral and Energy Resources

Utilization of minerals produced on the Custer Gallatin National Forest serves to benefit the national clean air interest through the use of palladium in the automotive industry. Development of mineral material from quarries and pits located on the Custer Gallatin is used to maintain and construct new roads, develop recreation sites, trail heads, and other facilities.

Carbon, Carter, Harding, Madison (MT), Meagher, Park (MT), Powder River, and Sweet Grass county growth polices all cited mineral extraction as important to their local economies. Specifically, Big-Horn, Park, and Powder River cited coal extraction as important. Carbon, Carter, Harding, Powder River, and Sweet Grass cited oil extraction as important. The 2016 Rural Montana survey (Muste, 2016) data showed that 9.9 percent of respondents thought Federal lands should be managed to increase economic development from oil, gas, and mining. Eighty-one percent of respondents were concerned about the possibility of toxic mine waste or other waste leaking into Montana’s water sources. Forty percent of local stakeholder survey respondents listed oil, gas, and mineral development as a very or extremely important purpose of their local, Federal public lands.

Oil, gas, and mineral development has the potential to create boom towns, which have been linked to increased crime, higher levels of income inequality, and decreases in social cohesion (Smith et al. 2001). Carbon, Park (MT), Powder River, and Rosebud counties may be particularly vulnerable to the negative impacts of boom towns as they already have elevated levels of income inequality and violent crime. Harding County (SD) is also vulnerable to social impacts due to its proximity to North Dakota shale boom towns. Greenhouse gas emissions have been identified by the Environmental Protection Agency as a danger to human health. Emissions that result from oil, gas, and mineral development may impact human health. Global economic forces, commodity prices, and the changing needs or desires of society to produce and use these products may impact the mining of mineral resources located on the Custer Gallatin National Forest. For more information on this benefit, see the energy, minerals, and geologic areas of interest analysis.

Preservation of Historic, Cultural, Tribal or Archeological Sites

Intact cultural landscapes on the Custer Gallatin National Forest provide a sense of place and continuity that can enhance the quality of life and well-being for the public, especially for those communities that rely on the Custer Gallatin for their lifeway and income. Cultural resources have been found to provide inspiration, and personal, even spiritual, experiences. The tangible evidence of past activities such as fasting and eagle trapping, mining town locations, and historic inscriptions have provided awe-inspiring experiences. Cultural site touring and visitation are growing activities within the planning area. Tourists are attracted by the nature and significance of historic properties and by the character of traditional communities, a character maintained by resources and uses of the Custer Gallatin National Forest. Adaptive reuse of historic buildings into recreation cabin rentals and educational centers promote both tourism and preservation of these irreplaceable resources. Interpreted sites like the Main Boulder Station afford an opportunity to educate the public about the history of the Custer Gallatin National Forest and the region. Furthermore, cultural resources on the Custer Gallatin can make scientific contributions to our society by expanding our knowledge and understanding of history and culture, and by connecting us to our collective heritage.

The Custer Gallatin is within the aboriginal territories of a number of present day Tribes, including the Great Sioux Nation, the Three Affiliated Tribes, Fort Peck Tribes, Northern Cheyenne Tribe, the Crow Tribe, the Assiniboine, the Blackfeet, the Shoshoni Tribe, the Arapahoe Tribe, the Shoshone Bannock Tribe, the Nez Perce, the Confederated Salish Kootenai, and the Nez Perce band of the Umatilla. Many of the Tribes retain reserved treaty rights within the planning area to use these lands for traditional purposes. Activities such as the right to hunt and gather on unoccupied lands outside of the present day reservation boundaries are examples of these reserved rights, including the collection of traditionally used plant materials such as teepee poles and medicines, and certain hunting rights (for example, bison hunting outside Yellowstone National Park). The Forest Service is charged with implementing programs and activities honoring Native American treaty rights and fulfilling legally mandated trust responsibilities to the extent that they are determined applicable to National Forest System lands (Forest Service Manual 1563). Carbon, Carter, Harding, Gallatin, Madison, Meagher, Park, and Powder River county growth polices all cited preservation of one (or more) of the following as important to residents and their local economies: cultural landscapes, history, archeological and geological sites, sacred lands, and caves. Approximately half (50 percent) of local stakeholder respondents noted that they currently have access to areas of cultural or traditional significance on their local Federal public lands.

For more information on historic, cultural, tribal or archeological sites and caves on the Custer Gallatin National Forest, refer to the cultural and historic resources, areas of tribal importance, energy, minerals, and geologic areas of interest, and the Nez Perce Trail discussions in the designated areas analyses.

Recreation

Outdoor recreation helps add meaning to life, to gain stories and memories. Outdoor recreation helps people achieve goals, to learn new skills or knowledge, to test oneself, to enhance personal growth. It also helps create balance in one’s life, reducing stress, as a recuperative activity, and to help one regain physical or mental health. Recreation provides stimulation: fun, excitement, adventure, the chance to do something different. Outdoor recreation helps underscore people’s sense of belonging as they engage in recreation with family and friends. The Custer Gallatin serves as community backdrops and backyards for daily recreation opportunities. The vast majority (72 percent) of local stakeholder survey respondents listed recreational opportunities as a very or extremely important purpose of their local, Federal public lands. Carbon, Gallatin, Madison, and Park (MT) county growth polices all cited preservation of scenery as important to residents and their local economies. Carbon, Carter, and Harding counties also cited access to recreation, in general, as important. Other counties listed specific recreation activities as important. The growing populations around the Custer Gallatin National Forest are expected to create new and increasing demands for recreation access. The 2016 Rural Montana survey (Muste, 2016) data showed that 13.9 percent of respondents thought Federal lands should be managed to increase recreation opportunities. Big Horn, Carbon, Madison, Rosebud, and Stillwater counties all rate in the bottom quartiles on access to exercise. Expanding opportunities for recreation could improve access to exercise in these counties. Timber harvest, oil, gas, and mineral development may impact recreation access and experiences.

For more information on recreation, refer to the recreation opportunities, settings, and access and designated areas analyses.

Scenery

Mountains, alpine landscapes, and prairie vistas contribute to the scenic nature of forest. Use of these unique landscapes through recreational activities has increased during the last decade and are expected to continue to increase in the future. The National Forest System lands within the Custer Gallatin National Forest represent extremely unique and thus valuable scenery when compared to surrounding landscape within each landscape character type that includes all land ownership. In the ecological section that includes the Madison, Henrys Lake, Gallatin; Absaroka-Beartooth; and Bridger, Bangtail, and Crazy Mountain landscape areas of the Custer Gallatin National Forest, roughly 36 percent of that National Forest System land is “Class A distinctive” scenery. In the ecological section that includes the Pryor Mountains, Ashland, and Sioux landscape areas, roughly 89 percent of the National Forest System land is “Class A distinctive” scenery. The majority (76 percent) of local stakeholder survey respondents identified providing scenic beauty as a very or extremely important purpose of their local Federal public lands. The fact that vacation homes are very prevalent in communities around the western areas of the Custer Gallatin highlights the importance of scenery to part-time residents in those communities.

3.11.3 Environmental Consequences (Social Consequences)

The previous sections assessed the social conditions of the affected environment and the social benefits the Custer Gallatin National Forest provides. The affected environment section provides a baseline understanding of how the Custer Gallatin currently contributes to social sustainability, for local beneficiaries and the general public, where applicable. The key dimensions of social sustainability assessed are how the Custer Gallatin (and forest management) contribute to the quality of life of the public. The following section considers the potential impacts of alternative management scenarios on these contributions. This section provides a brief summary of the expected impacts to the social benefits the national forest provides, and explores how those impacts may affect contributions to social sustainability, considering the current and expected social conditions (for example, urbanization, projected population change, aging, etc.), where relevant. For more details and the complete analysis of effects to specific forest resources, refer to the relevant resource analysis.

Current Plans

Management Direction under the Current Plans

The 1986 Custer Forest Plan addressed “Rural Community and Human Services” in two ways.

> First, the forest will provide direct and indirect employment opportunities through personnel programs and through jobs created by user groups as they utilize national forest resources. The forest will increase opportunities for minorities, senior citizens, the handicapped, and the disadvantaged to enjoy the national forest. The Custer Gallatin will work with job services and educational institutions in Montana, North Dakota, and South Dakota to utilize programs such as CETA, work study, and others. The forest will emphasize the volunteer program for the dual purpose of work accomplishment and the training and experience.
>
> Second, the forest and ranger districts will continue contacts with tribal governments to identify opportunities for lending assistance. As needs arise, the forests and districts will support tribal government’s efforts to develop and manage their natural resources.

The 1987 Gallatin Forest Plan provided no specific direction on community conditions. Instead the plan is focused on providing a suite of benefits to forest users including recreation opportunities and access, scenery, clean water, cultural resources, timber, minerals, grazing, fish, wildlife, water quality, wilderness, wild and scenic river and fire protection. There is no explicit mention of supporting communities directly. Instead, the focus of the plan is on those specific benefits the national forest provides to users. Under the management guidance, a summary of benefits the public is most concerned with are described:

> Many people see the forest as being very important in their lives. At public workshops people have said that activities such as hiking, camping, picnicking, hunting and fishing, snowmobiling, trail biking, skiing, and firewood gathering are significant to them. Watersheds, big game, livestock, minerals, oil, gas, and timber are resources which people have identified as important to them. (Gallatin Forest Plan 1987)

Effects of the Current Plans

Under the current plans, the Custer Gallatin will continue to provide the full suite of social benefits that currently contribute to social sustainability, as described in the affected environment section. For more details on each benefit, please see the relevant specialist report.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

All revised plan alternatives contain the same overarching desired conditions for contributions to social sustainability. These desired conditions focus on providing key social benefits of the Custer Gallatin to enhance the quality of life of local stakeholders and the public at large. Additionally, plan components under the relevant resource areas are designed to provide social benefits, where applicable and feasible.

Effects of the Revised Plan Alternatives

Under alternatives B through E, the Custer Gallatin would continue to provide the full suite of social benefits which currently contribute to social sustainability, as described in the affected environment section. Under all revised plan alternatives, contributions to social sustainability are expected to be greater than under the existing plans. This is due to new management direction across resource areas focused on enhancing ecological integrity, wildlife habitat, preserving undeveloped areas, and providing opportunities to connect with nature through recreation, partnerships, volunteering, and educational programs. The relative level of expected social benefits from educational and volunteer programs and employee service to communities are not expected to vary across revised plan alternatives.

The level of clean air, clean water, aquatic ecosystem and flood control, conservation of ecosystems, designated areas, forest products, support for grazing and domestic livestock production, infrastructure, inspiration, access to mineral and energy resources, preservation of historic, cultural, tribal or archeological sites and caves, recreation opportunities and access, and scenery provided by the Custer Gallatin is expected to vary by alternative. Thus, the relative contributions to social sustainability at local and national scales vary by alternative and by the preferences of local and national publics.

Clean Air

Contributions would be similar under the current plans, alternatives B, C, and D, and highest under alternative E. This is due to differences in anticipated levels of prescribed fires. Under alternative E, the Custer Gallatin is expected to conduct prescribed burning on fewer acres, compared to all other alternatives.

Clean Water, Aquatic Ecosystems and Flood Control

Human populations in areas dependent on the Custer Gallatin for clean water, such as Bozeman, are projected to continue to grow over the life of the plan. Therefore, demand for clean water is expected to increase. Contributions would be similar under alternatives B and C, highest under alternative D, and lowest under alternative E. These differences are mainly a function of the variations across alternatives in acres allocated as recommended wilderness areas, and the protections the recommended wilderness areas designation provides for soils and watersheds (for example, no road construction or motorized use permitted). The higher levels of expected timber harvest and motorized use under alternative E may reduce the magnitude of the Custer Gallatin's contributions. Revised plan alternatives propose wider riparian management zones than the current plans, with more detailed guidance. The current plans do not incorporate as much detail and clarity regarding the conditions and management of watersheds, and thus, contributions to the integrity and resilience of watersheds are expected to be less robust compared to the revised plan alternatives.

Conservation of Ecosystems (lands, rare plants, and species for fishing, hunting, and wildlife viewing)

Increases in local rural populations and tourism suggest an increase in demand for fishing, hunting, and wildlife viewing opportunities. Publics also have an increasing interest in conversing biodiversity, ecosystem integrity and rare species. All revised plan alternatives have more detailed guidance for vegetation and aquatic community diversity and resilience than the current plans. Contributions would be similar under alternatives B, C, and E; highest under alternative D, and lowest under the current plans. These differences are a function of the variations across alternatives in acres allocated as recommended wilderness areas and backcountry areas, and the protections the recommended wilderness areas and backcountry areas land allocations provide for wildlife and rare species (for example, wildlife connectivity, lower likelihood of plant disturbance, lower threats of invasive species spread). The current plans do not incorporate as much detail and clarity regarding the desired extent, frequency and severity of ecosystem processes which, in turn, drive ecological structure and composition. Contributions of ecosystem integrity and resilience are expected to be less robust under the current plans compared to revised plan alternatives.

Designated Areas and Land Allocations

All revised plan alternatives provide protections for currently designated areas and forest plan land allocations. Contributions would be larger under the revised plan alternatives, compared to the current plans. The revised plan alternatives also provide new land allocations which benefit different stakeholder groups. Twenty-nine percent of local stakeholder survey respondents and many public comments noted there is currently not enough designated wilderness. For those stakeholders most inspired and dedicated to the preservation of wilderness landscapes, contributions will be greatest under alternative D. Twenty-five percent of local respondents noted that there is not enough designated wilderness or preserved wildlands. Fifty-eight percent of local respondents and many public comments noted there is either enough or too much designated wilderness. For those stakeholders who favor multiple-use management on a larger portion of the Custer Gallatin, contributions will be greatest under the current plans.

Fire and Fuels Management

Local stakeholders are overall supportive of fuels treatments near communities and, particularly in the wildland urban interface, to reduce wildfire risk. Survey respondents and participants at public meetings expressed the need to increase fire mitigation activities above current levels. Therefore, contributions would be largest under alternative D as it is expected to treat the most acres for hazardous fuels reduction, followed by the current plans, alternatives B, C, and then E. Alternative E would be the least responsive in obtaining desired fuel conditions within the wildland urban interface.

Forest Products (including timber, firewood, Christmas trees, berries, mushrooms)

Contributions are expected to be largest under the revised plan alternatives, compared to the current plans, due to more explicit plan direction designed to support sustainable levels of timber, special forest and botanical products. Timber outputs are expected to be largest under alternative E and smallest under alternative D. Forty-nine percent of local survey respondents noted that economic contributions to the timber industry is an important use of local, Federal public lands. For these respondents, representing approximately half of local stakeholders, contributions will be largest under alternative E and smallest under alternative D. New land allocations under the revised plan alternatives B, C, and D such as recommended wilderness and backcountry areas may affect ease of access to collect forest products, due to restrictions on motorized and mechanized travel in those areas. Impacts to ease of access via changes to current motorized and mechanized travel are expected to be largest under alternative D, followed by alternative C.

Permitted Livestock Grazing

All revised plan alternatives provide protections for forage and allow for current levels of grazing opportunities to continue. Contributions to rangeland health would be larger under the revised plan alternatives, compared to the current plans, due to more explicit plan direction designed to promote rangeland health and reduce invasive species. Threats to native vegetation would be highest under alternative E, due to the lowest level of expected weed treatments and less focus on promoting ecosystem integrity. Local stakeholders expressed concern with invasive species and the impact weeds may have on grazing opportunities. Local stakeholders also expressed concern for conflicts between bison and livestock. Some stakeholders favor protections bison, while others favor protections for livestock. Alternative E includes plan components that favor livestock over bison, in the case of conflicts. Alternative E is expected to provide smaller contributions to those who favor bison and larger contributions to those who favor livestock, compared to all other revised plan alternatives. New land allocations under the revised plan alternatives such as recommended wilderness, backcountry areas and recreation emphasis areas may affect grazing permittees in terms of allotment access, operability, ease of management and increased user conflicts (for example, in cases where recreation areas overlap grazing allotments). Alternative D would affect the most permittees, followed by alternatives C, B and E. The current plans are the least restrictive to allotment administration and thus least likely to impact contributions to grazing permittees.

Infrastructure

All revised plan alternatives provide protections for infrastructure. Contributions would be largest under the current plans alternatives B, and C, compared to alternatives D and E, due to a higher expected level of road and trail maintenance for public use under these alternatives. For stakeholders interested in airstrip access, alternative D provides the smallest contribution, as airstrips are not permitted under alternative D.

Inspiration

Contributions would be similar under the revised plan alternatives, and lowest under the current plan. These differences are a function of the variations across alternatives in acres allocated to areas designated to protect awe-inspiring wildlife, rare species, scenic integrity, inspirational cultural resources and provide visitors with opportunities to be inspired by nature. Some stakeholders may find more inspiration in recreation emphasis areas while others may find more inspiration in recommended wilderness areas or backcountry areas, thus contributions are expected to be similar across the revised plan alternatives, as each provides a mix of land allocations designed to suite different stakeholder preferences.

Mineral and Energy Resources

Forty percent of local survey respondents, several public comments, and a host of county growth polices noted that the economic contributions to minerals industries are important uses of local, Federal public lands. For these stakeholders, contributions are expected to be largest under the current plans, followed by alternatives E, B, C, then D. Differential contributions are due to differences in land allocations (for example backcountry areas and recommended wilderness areas) across alternatives and the associated restrictions on extraction of salable mineral material, expected increases in the length of time to process a plan of operations, additional mitigation requirements and additional costs for the operations.

Preservation of Historic, Cultural, Tribal or Archeological Sites

All revised plan alternatives provide protections for historic, cultural, tribal, or archeological sites and caves contributions would be largest under the revised plan alternatives given land allocations for backcountry areas and recommended wilderness areas, which provide added protections for sites of tribal and cultural significance. Motorized and mechanized access to sites of tribal and cultural significance may be more impacted under alternative D, but protections are greater, compared to alternatives B, C, and E. The current plans provide the most access yet the fewest protections, compared to the revised plan alternatives.

Recreation

All alternatives provide a variety of recreation opportunity settings and access. Contributions vary by alternative by stakeholder group due to differences in land allocations for backcountry areas, recommended wilderness areas, and recreation emphasis areas, and the associated recreation opportunities available. The current plans do not include any recreation emphasis areas, and thus is expected to contribute the least, compared to the revised plan alternatives. Local survey respondents, public comments, and county growth policies all noted that proving recreation opportunities is a very important purpose of the Custer Gallatin National Forest. Stakeholders vary in their preferences for recreation opportunities. While most local stakeholders and visitors engage in non-motorized and non-mechanized recreation and many local respondents are currently satisfied with the level of mechanized and motorized opportunities. However, some feel there are not enough motorized or mechanized opportunities. For those who feel there are currently not enough mechanized or motorized opportunities (five percent and thirty-two percent of local respondents, respectively), alternative E may provide the largest contribution and D the smallest, due to the differential in limitations placed on motorized and mechanized uses. Twenty-two percent of respondents and many public comments also noted experiencing conflict with users using different modes of transportation. Under alternatives B, and C and D, the added land allocations of backcountry areas, recommended wilderness areas, and recreation emphasis areas, may lead to the alleviation of user conflicts given the limitations in some areas on new motorized and mechanized recreation uses in alternative B or on new and existing motorized and mechanized recreation uses in alternatives C and D. Forty-nine percent of local respondents and some public comments also noted concern about road conditions. Under the current plans, alternatives B, and C, more miles of roads and trails for recreation would be maintained, compared to alternatives D and E. Twenty-two percent of respondents and many public comments also noted experiencing conflict with users using different modes of transportation. Under alternatives B, C, and D, the added land allocations of backcountry areas, recommended wilderness areas, and recreation emphasis areas, may lead to the alleviation of user conflicts given the limitations in some areas on new motorized and mechanized recreation uses in alternative B or on new and existing motorized and mechanized recreation uses in alternatives C and D. Forty-nine percent of local respondents and some public comments also noted concern about road conditions. Under the current plans, alternatives B, and C, more miles of roads and trails for recreation would be maintained, compared to alternatives D and E. Some infrastructure and special events in recommended wilderness areas may no longer to available under alternative D and to a lesser extent under alternative C, which may result in negative impacts to those user groups.

Scenery

All revised plan alternatives provide protections of scenic beauty. The Custer Gallatin will continue to provide scenic beauty, which currently contributes to social sustainability. Seventy-six percent of local survey respondents and public comments noted that providing scenic beauty is a very or extremely important purpose of the Custer Gallatin National Forest. Contributions are expected to be largest under alternatives D, followed by C, B, the current plans, and then alternative E, given the associated land allocations for recommended wilderness areas, which require the highest level of scenic integrity to be maintained.

Environmental Justice

The social area of influence contains Native American and low-income populations classified as environmental justice communities. Contributions to the Native American communities would likely be greatest under alternatives C and B due to the balance of protections and access to sites of traditional and cultural significance, and areas to collect forest products. Alternative E would likely contribute the least to these communities given that it offers the fewest protections to areas of traditional and cultural significance. Alternative D limits motorized access to some areas of traditional and cultural significance and areas to collect forest products, which may in turn negatively impact environmental justice community members’ ability to participate in cultural activities or forage for forest products.

Negative impacts to the economic sustainability of low-income communities are not expected under any alternative. Economic contributions to low-income, Native and non-Native communities with capacity to work in the timber industry may be greatest under alternative E as this alternative places the greatest emphasis on employment in the timber industry. Alternative E places the fewest limitations on motorized and mechanized forest access and thus may provide greater economic opportunities for low-income communities to develop a recreation economy based on motorized and mechanized recreation. Conversely, alternative D recommends the most acres for wilderness designation, and thus may provide the greatest economic opportunities for low-income communities to develop a recreation economy based on wilderness recreation.

New land allocations under the revised plan alternatives such as recommended wilderness, backcountry and recreation emphasis areas may affect grazing permittees located in environmental justice communities. These new land allocations may increase costs to permittees in terms of allotment access, operability, and management. Alternative D would affect the most permittees, followed by alternatives B, C, and E. Due to data constraints, it is not possible to identify whether grazing permittees affected by land allocations (backcountry areas, recommended wilderness areas, and recreation emphasis areas) in the revised plan alternatives are of low-income. However, there are current grazing permit holders residing in low-income communities located near affected grazing allotments, particularly in the Eastern part of the Custer Gallatin National Forest. The current plans are the least restrictive to allotment administration and thus least likely to affect grazing permittees.

Economic Consequences

All alternatives provide similar economic contributions in relation to employment and labor income. Results of the economic contribution analysis appear in the two tables below. In table 68, employment refers to levels of average annual jobs in and industry, and includes full and part-time employment. In table 69, labor income refers specifically to earned wage or proprietor income and does not include Social Security, Medicaid, dividends, or capital gains (for example, government programs or investments).

Income and employment levels contributed by the Custer Gallatin land and operations do not fluctuate widely between alternatives. However, as shown in table 68 and table 69, income and employment are different across alternatives due to changing assumptions regarding forest management activities under the timber and range programs. Between alternatives B through E, job contributions range between 5,685 and 5,842 jobs, and labor income between $238 million and $251 million.

All alternatives are estimated, with current resource assumptions, to produce more jobs and income over current levels, with alternative E producing the most. Variation in employment, across alternatives stems from known differences in wood quantities sold, and hence more or fewer jobs from timber resources. It is anticipated that recreation related visitation to the Custer Gallatin will increase over time, regardless of the alternatives and so the economic impact model does not differentiate visitation levels, or the recreation impacts between alternatives. However, increased local and non-local visitation is anticipated through factors on and off forest that remain external to a forest plan decision. Other economic benefits not analyzed directly, including nonmonetary benefits for forest stakeholders and consumer surplus for various recreation user groups, would vary between alternatives in parallel with ecosystem and resource availability and recreation opportunities, respectively. For more information on ecosystems, resources, or recreation affects across alternatives see each respective specialist report.

The greatest contribution to employment and income from the Custer Gallatin comes through forest service provided recreation opportunities, as well as mineral administration of the Stillwater Mines, and other energy resource industries.

More information regarding the following two tables is found in the project document entitled “Details of the IMPLAN economic impact analysis for the Custer Gallatin Forest Plan Draft Environmental Impact Statement.”

Table 68. Employment in the analysis area by resource and by alternative (direct employment contribution, estimated number of jobs)

Resource	Current	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Recreation: all	2,728	2,728	2,728	2,728	2,728	2,728
Wildlife and Fish Recreation: all	196	196	196	196	196	196
Grazing	377	387	387	387	377	377
Timber	191	448	451	451	330	619
Minerals	1,252	1,252	1,252	1,252	1,252	1,252
Payments to States/Counties	151	151	151	151	151	151
Forest Service Expenditures	520	520	520	520	520	520
Custer Gallatin Total	5,415	5,682	5,685	5,685	5,554	5,842
Percent Change	---	4.9%	5.0%	5.0%	2.6%	7.9%

A represents the current plans projected information if kept

Table 69. Labor Income in the analysis area by resource and by alternative (average annual labor income, in thousands of 2016 U.S. dollars)

Resource	Current	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Recreation: all	$79,526	$79,526	$79,526	$79,526	$79,526	$79,526
Wildlife and Fish Recreation: all	$6,107	$6,107	$6,107	$6,107	$6,107	$6,107
Grazing	$12,342	$12,689	$12,689	$12,689	$12,342	$12,342
Timber	$8,860	$20,791	$20,912	$20,912	$15,327	$28,732
Minerals	$93,100	$93,100	$93,100	$93,100	$93,100	$93,100
Payments to States/Counties	$7,416	$7,416	$7,416	$7,416	$7,416	$7,416
Forest Service Expenditures	$24,160	$24,160	$24,160	$24,160	$24,160	$24,160
Custer Gallatin Total	$231,511	$243,789	$243,910	$243,910	$237,977	$251,383
Percent Change	---	5.3%	5.4%	5.4%	2.8%	8.6%

A represents the current plans projected information if kept

Cumulative Effects

Societal trends of population growth, urbanization, and growth in travel and tourism may impact the Custer Gallatin's ability to contribute to social sustainability over the next 10 to 15 years. Based on the review of county growth policies, as referenced in the affected environment section, cumulative effects to the Custer Gallatin's ability to contribute to social sustainability over the next 10 to 15 years are not expected from the implementation of county growth plans. On the western side of the Custer Gallatin National Forest, significant population growth is likely through 2030 (Gallatin County Office 2003). Managing people, their direct use of the Custer Gallatin, and their demand for a diverse array of benefits will remain a challenge for Custer Gallatin National Forest managers. On the eastern side of the Custer Gallatin, population growth is expected in smaller communities and may increase demands for social benefits as well, particularly those associated with a rural lifestyle such as grazing, hunting, and fishing. All revised plan alternatives considered population growth, urbanization, and increasing pressures from tourism, and are designed to mitigate resource impacts from these known stressors.

Conclusion

Under alternatives B through E, the Custer Gallatin would continue to provide the full suite of social benefits which currently contribute to social sustainability, as described in the affected environment section. The relative magnitude of contributions to social sustainability vary by alternative. In this analysis, contributions to social sustainability are operationalized as key social benefits which enhance the quality of life of local stakeholders and the public at large. Overall, the revised plan alternatives are expected to provide greater relative contributions to social sustainability, compared to the current plans. The current plans do not provide a unified plan for the administratively combined units and does not take into account to the same degree the best available scientific information for ecosystem management. The relative differences in contributions to social sustainability among the revised plan alternatives vary by stakeholder group as some stakeholders prioritize certain key forest benefits over others.

Given the diversity of management preferences across both local and national stakeholder groups, it is not possible to unequivocally identify which revised plan alternative provides the greatest overall contribution to social sustainability for all stakeholders. Alternative D is likely to provide the greatest contributions to those who prioritize scenery, non-motorized recreation, wilderness, fish and wildlife, cultural, historic, and tribal resource protections. Alternative E provides the greatest contributions to those who prioritize developed recreation opportunities, motorized recreation, timber volume, timber industry jobs, livestock protections, and opportunities for energy and mineral extraction. Alternatives B and C provide a mix of contributions to social sustainability across all stakeholder groups.

Table 70 itemizes the relative contributions of key forest benefits to social and economic sustainability by alternative. When relative contributions are expected to be similar, alternatives are listed in the same box in alphabetical order.

Table 70. Relative contributions to social and economic sustainability by alternative

Key Social Benefit from the Forest	Relative Contributions Greatest				Smallest
Clean air	E	ABCD			
Clean water, aquatic ecosystems, and flood control	D	C	B	E	*A
Conservation of ecosystems (lands, rare plants, and species for fishing, hunting, and wildlife viewing)	D	C	B	E	A
Designated areas	BCDE	A			
Educational and volunteer programs	BCDE	A			
Employee service to communities	BCDE	A			
Fire suppression and fuels management	D	ABC			E
Forest products (including timber, firewood, Christmas trees, berries, mushrooms)	E	B	C	D	A
Permitted livestock grazing	A	E	B	C	D
Income (payments in lieu of taxes, secure rural schools, labor income in various industries: recreation, timber, grazing, etc.)	E	BC	D	A	
Infrastructure	ABC	E	D		
Inspiration (including spiritual inspiration)	BCD	A	E		
Jobs (and induced jobs, including recreation, timber, grazing, etc.)	E	BC	D	A	
Mineral and energy resources	A	E	B	C	D
Preservation of historic, cultural, tribal or archeological sites	D	C	B	A	E
Sustainable recreation	BCDE	A			
Scenery	D	C	B	A	E

*Alternative A represents the current plans in this table

3.12 Areas of Tribal Importance

3.12.1 Introduction

This section discusses the unique relationship the U.S. Government and the Forest Service has with federally recognized Tribes. The Forest Service recognizes specific trust responsibilities with the Tribes and administers the Custer Gallatin with these responsibilities in mind. At least 18 Tribes have treaty-reserved rights to resources on the national forest and they recognize the lands administered by the Custer Gallatin National Forest as part of their aboriginal or traditional use areas. Many Tribes still use these lands and resources for traditional, cultural, religious and ceremonial activities.

Regulatory Framework

The Custer Gallatin National Forest holds in public trust a great diversity of landscapes and sites, including many culturally important sites held sacred by Indian Tribes. The Forest Service's responsibility to protect tribal cultural resources and sacred sites is codified in laws, executive orders, legislation, regulation, and other statutory authorities. Some authorities relate to cultural resources as sites of historical importance and other authorities relate to sacred sites as places of religious or spiritual importance.

Applicable laws, policy, direction and regulation provide for the management direction for tribal relations and issues, and are set forth in the revised and March 2016 update Forest Service Manual 1500, Chapter 1560 – State, tribal, county, and local agencies; public and private organizations. A summary of laws, regulations, and policies are included below.

Federal Land Policy and Management Act (FLPMA), 43 U.S.C. 1701-1784 (1976): requires coordination of land use plans for lands in the National Forest System with the land use planning and management programs of and for Indian Tribes. Directs the Forest Service to manage National Forest System lands on the basis of multiple use, in a manner that "recognizes the Nation's need for domestic sources of minerals, food, timber, and fiber from the public lands" and that will "protect the quality of …historical… resources, and archeological values."

National Environmental Policy Act (NEPA of 1969, 42 U.S.C. 4321 et seq.): requires forest agencies to invite Indian Tribes to participate in the scoping process for projects and activities that affect Indian Tribes and requires National Environmental Policy Act documentation.

American Indian Religious Freedom Act (AIRFA) (42 U.S.C. 1996): states that "...it shall be the policy of the United States to protect and preserve for American Indians their inherent right for freedom to believe, express, and exercise the traditional religions of the American Indian, Eskimo, Aleut, and Native Hawaiians, including, but not limited to access to site, use and possession of sacred objects, and the freedom to worship through ceremonies and traditional rites."

Archaeological Resources Protection Act of 1979 (ARPA) (16 U.S.C. 470cc et seq.) as amended: Public Law 96-95 and Regulations 43 CFR Part 7 establishes a permit process for the management of cultural sites on Federal lands which provides for consultation with affected tribal governments.

National Historic Preservation Act of 1966 (NHPA) (54 U.S.C. 300101 et seq.) as amended in 1992): requires Federal agency officials to consult with Indian Tribes concerning the effects of undertakings on historic properties of traditional and cultural importance to the Tribes.

Native American Graves Protection and Repatriation Act of 1990 (NAGPRA), 25 U.S.C. 3001 et seq.), amended in 1992: addresses the rights of lineal descendants and members of Indian Tribes and Alaska Native and native Hawaiian organizations to certain human remains and precisely defined cultural items. It covers items currently in Federal repositories as well as future discoveries. The law requires Federal agencies and museums to provide an inventory and summary of human remains and associative funerary objects. The law also provides for criminal penalties in the illegal trafficking in Native American human remains and cultural items.

Executive Order 12898 of 1994—environmental justice in minority populations and low-income populations: directs Federal agencies to focus on the human health and environmental conditions in minority and low-income communities, especially in instances where decisions may adversely impact these populations.

Executive Order 13175—Consultation and Coordination with Indian Tribes, November 6, 2000: directs Federal agencies to establish regular and meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications, to strengthen the United States government-to-government relationships with Indian Tribes, and to reduce the imposition of unfunded mandates upon Indian Tribes. Public Law (P.L.) 108-199 and 108-477 added language that directed the

Office of Management and Budget and all Federal agencies to consult with Alaska Natives and Alaska Native Corporations on the same basis as Indian Tribes under Executive Order 13175.

Executive Order 13007, Indian Sacred Sites of 1996: directs Federal land management agencies, to the extent permitted by law, and not clearly inconsistent with essential agency functions, to accommodate access to and use of Indian sacred sites, to avoid affecting the physical integrity of such sites wherever possible, and, where appropriate, to maintain the confidentiality of sacred sites. Federal agencies are required to establish a process to assure that affected Indian Tribes are provided reasonable notice of proposed Federal actions or policies that may affect Indian sacred sites.

Title VIII, Subtitle B of the Food, Conservation, and Energy Act of 2008 (Farm Bill): Codified as the Cultural and Heritage Cooperation Authority (25 U.S.C. 32A). Includes provisions for reburial of human remains and cultural items, temporary closure for traditional and cultural purposes, forest products for traditional and cultural purposes, and prohibitions on disclosure of information.

Title 36, Code of Federal Regulations, Part 219 (Planning Rule): these regulations set forth a process for developing, adopting, and revising land and resource management plans for the National Forest System and prescribe how land and resource management planning is to be conducted on National Forest System lands. The rule directs the Forest Service to consult with and coordinate forest planning with Indian Tribes.

Cultural and Heritage Cooperation Authority (25 U.S.C. 3055): states the secretary of agriculture may provide free of charge to Indian Tribes any trees, portions of trees, or forest products from National Forest System land for traditional and cultural purposes, notwithstanding section 472a of title 16. Tree, portions of trees, or forest products provided under subsection (a) may not be used for commercial purposes. This authority also authorizes the secretary of agriculture to protect the confidentiality of certain information, including information that is culturally sensitive to Indian Tribes, and requires the Forest Service to consult with affected Indian Tribes before releasing culturally sensitive information.

36 CFR 261 Prohibitions in Areas Designated by Order; Closure of National Forest System Lands to Protect Privacy of Tribal Activities (2011): "provides regulations regarding special closures to provide for closure of National Forest System lands to protect the privacy of tribal activities for traditional and cultural purposes to ensure access to National Forest System land, to the maximum extent practicable, by Indian and Indian Tribes for traditional and cultural purposes."

36 CFR 223.239 and .240 Sale and Disposal of National Forest System Timber, Special Forest Products, and Forest Botanical Products: Section 223.239 provides regulations for free-use without a permit for members of Tribes with treaty or other reserved rights related to special forest products. Also free-use without a permit upon the request of the governing body of a Tribe. Section 223.240 provides regulations regarding harvest of special forest products by Tribes with treaty or other reserved rights.

Key Indicators and Measures

Forest plan components may affect the availability of resources and the use of traditional places important to American Indian rights and interests. A primary concern is the availability and protection of treaty reserved resources and cultural resources, including use and access to traditional places.

Key indicators from tribal comment centered on honoring their treaty-reserved rights; protection for plants and wildlife, particularly bison, bighorn sheep, preservation and protection of sacred sites, religious, ceremonial and cultural sites; culturally sensitive sites; traditional use locations; and continued access to these areas.

Key indicators used to qualitatively evaluate the effects of alternatives are:

- Protection of sacred sites, religious, ceremonial and cultural sites; culturally sensitive sites; traditional use locations, and potential to alter the integrity or setting, physically damage sites, introduce, visual, audible, or atmospheric elements that are out of character with the site, as measured in relative amount of land in recommended wilderness and backcountry area land allocations.
- Potential increase or decrease in access to sacred sites, religious, ceremonial and cultural sites; culturally sensitive sites; traditional use locations, measured in relative amount of land in recommended wilderness and backcountry area land allocations.
- Variations in bison and bighorn sheep plan components.

Methodology and Analysis Process

Effects to tribal interests are known through past and current tribal consultation between the Forest Service and affected Tribes as well as a number of ethnographic studies conducted with the Crow, Northern Cheyenne, Ft. Peck Tribes, the Three Affiliated Tribes, the Standing Rock, Cheyenne River; Lower Brule, Rosebud and Pine Ridge Sioux Tribes. Also considered in the analysis was the identification of the North Cave Hills, South Cave Hills, and Slim Buttes as lands with religious and cultural significance under all applicable historic preservation laws and Executive Order 113007 by tribal resolutions from the Lower Brule Sioux Tribes, Standing Rock Sioux Tribes, Cheyenne River Sioux Tribe, and the Rosebud Sioux Tribes.

The Crow, Cheyenne, Hidatsa, and Sioux have expressed concern over proper treatment of traditional cultural properties and burials located on the Sioux District, specifically Ludlow Cave, the Slim Buttes battlefield, eagle trapping lodges, and the Slim Buttes as a whole. Ludlow Cave, located in the North Cave Hills, is particularly revered as a one of the places from which buffalo first emerged from the earth and, surrounded by rock imagery, is a traditional cultural property.

Concerns raised by the Tribes through letters, emails, and meetings conducted during the initial phases of the revision effort were analyzed and addressed in the document. Six Tribes formally commented on the proposed action by letter. Their concerns include the protection of habitats on which the tribe's treaty rights rest; protection for bison and bighorn sheep; need for components addressing at-risk plant species, invasive species, species of conservation concern, general wildlife and tribal treaty-reserved resources; opposition to land sales or transfers to non-Federal entities; climate change; use of traditional ecological knowledge (TEK) for various species; and protection, preservation, and enhancement of religious, sacred and ceremonial sites, archaeological sites, traditional use sites, and the opportunity to continue traditional cultural practices.

During informational meetings with the Crow, Northern Cheyenne, Ft. Peck Tribes, Eastern Shoshoni, Araphoe, and the Mandan, Hidatsa, Arikara (MHA) additional concerns were expressed including concern about plants in the Tongue River Breaks and spring developments (Northern Cheyenne). Other concerns raised were regarding access in the Pryor Mountains, bison and bighorn sheep, and teepee pole availability (Crow); the need for interpretation that includes American Indian perspective

(Arapahoe, Shoshone-Bannock Tribes); protection of North Cave Hills (MHA); Nez Perce Trail and Bannock Trail, land exchanges, campground fees, larger landscape for bison, and hunting season closures for treaty Tribes (Shoshone Bannock Tribes).

Email from the Rosebud and Cheyenne Sioux say they want to be included in the forest plan revision effort.

During the review by the Tribes of the proposed action, two additional Indian Nations voiced concerns about the management of the Custer Gallatin National Forest (the Crow Creek Sioux Tribe from Fort Thompson, South Dakota and the Piikani Nation representing the Blackfeet Confederacy in Alberta, Canada). Both Nations have concerns centered on the treatment of bison and the honoring of reserved treaty rights. The chairman of the Crow Creek Sioux Tribe has asked to be included in formal consultation on the forest plan revision.

The issues expressed by the Tribes are evaluated using the indicators expressed above including treaty-reserved rights; protection for bison, bighorn sheep, and plant habitats; preservation and protection of sacred sites, cultural sites, and traditional use locations; and continued access to these areas.

Information Sources

Sources of information used include treaties for the Tribes surrounding the Custer Gallatin National Forest; cultural resource records; tribal qeb sites; past tribal consultation meetings; oil and gas leasing environmental impact statements; a number of ethnographic studies and cultural histories; and comments from Tribes received through letters, email and informational meetings during the initial phases of the forest plan revision efforts, including the proposed action.

The Custer Gallatin has worked with their tribal neighbors on a number of ethnographic studies in the last 20 and include an ethnographic or ethnohistoric overview of the Mckenzie, Medora, Sioux, Ashland, and Beartooth Districts (Deaver and Kooistra-Manning 1995, proprietary information). This was designed to give Forest Service personnel some of the background information needed to make informed decisions regarding the effects of land management decisions on traditional Indian communities.

Other ethnographic/ethnogeographic studies consulted for this assessment include the specific land based studies for the Pryor Mountain Unit (Nabokov and Loendorf 1994, proprietary information); South Dakota Units of the Sioux District (Sundstrom 1997, 2003, proprietary information, Lebeau 2006); Tongue River and Powder River Plateau (Boggs et al. 2010); Chalk Buttes (Chalk Buttes Elders et al 1996, proprietary information); Crazy Mountains (Allen 2002); and Yellowstone Park (Nabokov and Loendorf 2002).

Analysis Area

The analysis area includes the entire Custer Gallatin National Forest. The cumulative effects analysis area extends to cultural landscapes not wholly administrated by the Custer Gallatin National Forest including all the Crazy Mountains. The temporal scope of the analysis is the anticipated life of the plan.

3.12.2 Affected Environment (Existing Condition)

The Custer Gallatin National Forest administers a vast landscape that covers a range of ecological conditions, from the Prairie Pinelands to the mountains and alpine plateaus. These landscapes were and are the homelands of a number of American Indian Tribes. This is further reflected in the great diversity of organizational structures of tribal governments, roles of written and customary law, treaties, and cultural traditions and practices. Some Tribes have reserved treaty-protected rights while others have rights established by executive order or statue.

Because the governments and cultures of indigenous peoples are distinctively different, the Custer Gallatin National Forest works with each tribe individually and consults with 18 federally recognized Tribes located in North and South Dakota, Montana, Wyoming, Idaho, Oregon, and Washington. Those who have communicated interest in the natural and cultural resources and management of the Custer Gallatin National Forest as part of their aboriginal or traditional use areas include:

- MHA (Mandan, Hidatsa and Arikara) Nation (Sahnish)
- Standing Rock Sioux
- Cheyenne River Sioux Tribe
- Lower Brule Sioux Tribe
- Rosebud Sioux Tribe
- Pine Ridge Sioux Tribe
- Northern Cheyenne Tribe
- Ft. Peck Sioux and Assiniboine Tribes
- Confederated Salish Kootenai Tribes
- Nez Perce Tribe
- Umatilla Confederated Tribes
- Shoshone Bannock Tribe
- Eastern Shoshone Tribe
- Arapahoe Tribe
- Crow Tribe
- Crow Creek Sioux Tribe
- Confederated Bands and Tribes of the Yakama Nation
- Blackfeet Nation

The Forest Service makes decisions that may limit the use of lands over which it has trustee responsibilities. Lands currently administered by the Custer Gallatin National Forest contain areas and landmarks, which are part of complex mythologies and sacred landscapes developed within the homelands of the tribal groups whom occupied the lands prior to European arrival. Areas of known traditional use and identified cultural landscapes include the North Cave Hills, Slim Buttes, Chalk Buttes (Sioux Geographic Area); Tongue River Breaks (Ashland Geographic Area); the Pryor Mountains (Pryor Mountains Geographic Area) and the Crazy Mountains (Bridger, Bangtail, and Crazy Mountains Geographic Area). The North Cave Hills, South Cave Hills and Slim Buttes within the Sioux GA were formally recognized by four Tribes as sacred sites under Executive Order 13007, Indian Sacred Sites of 1996.

Traditional plant materials are widely gathered and used by tribal members across the planning area. Lists of significant plants collected have been submitted to the Custer Gallatin from the Crow, Northern Cheyenne, Sioux, and Shoshone Bannock, many of which are integral in traditional ceremonies and practices. A few of these many plants listed include camas, bitterroot, Lomatium, box elder trees, juniper, white sage, purple coneflower, golden aster, sumac, prairie turnip, yucca, buffalo berry, rose hips, green ash, wild licorice, prairie June grass, chokecherry, golden current, and horsemint.

Commissary Ridge in the Pryor Mountain Geographic Area has been identified as an important plant gathering location for the Crow. The foothills of the Pryors are known to the Northern Cheyenne as an important plant gathering area – the plants in this area are reported to be particularly hardy, producing stronger medicine. Plant collection areas are also located within the Chalk Buttes (Sioux Geographic Area), and the Tongue River Breaks (Ashland GA). The West

Rosebud (Absaroka Beartooth Mountains Geographic Area) has been a plant collection location since precontact times.

Bison hold a sacred significance to all the Tribes in the planning area as they have been a principal means of subsistence and spirituality. Despite its near extinction in the late 1800s the bison continue to play an important role in tribal traditional beliefs and practices. Reconnection with the traditional hunting of bison that are now exiting Yellowstone National Park by Tribes exercising their treaty rights has been occurring on the Gardiner and Hebgen Lake Districts.

A number of minerals such as steatite, obsidian, and soapstone or pipestone are collected on the Custer Gallatin, along with clays, for paint. Certain fossils such as baculites, belemites, and ammonites continue to be recognized by the Crow, Arapaho, Hidatsa, Northern Cheyenne and others as having spiritual power and are collected on the national forest.

Climate change has been expressed as a tribal concern in forest plan comment letters. Projected changes in temperatures, precipitation, and hydrology threaten lands, resources, and economies of the Tribes; as well as tribal aboriginal territories, ceremonial sites, burial sites, tribal traditions, and cultural practices that rely on native plant, fish, and wildlife species and their habitat. Changes in the natural resources that comprise sacred places and setting, and traditional cultural practices may degrade as a result of climate-induced changes. Climate change may also affect the quality and availability of forest products used for traditional purposes upon which the Tribes depend for cultural continuity (Halofsky et al. 2018a,b).

Treaties

Indian treaty rights are property rights held by the sovereign Indian Tribes who signed the treaties. Each treaty is unique but, generally speaking, Indian Tribes reserved separate, isolated reservation lands under the treaties and many retained certain rights to hunt, fish, graze, and gather on the lands ceded to the United States. These rights retained on ceded lands are known as “off-reservation treaty rights” or “other reserved rights.” Trust responsibility arises from the United States' unique legal and political relationship with Indian Tribes. It derives from the Federal Government's consistent promise, in the treaties that it signed, to protect the safety and well-being of the Indian Tribes and tribal members. The Federal trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal treaty rights, lands, assets, and resources, as well as a duty to carry out the mandates of Federal law with respect to all federally recognized American Indian and Alaska Native Tribes and villages.

Modern tribal groups associated with the Custer Gallatin National Forest today live primarily on reservations established between the late 1850s and 1880s through a number of treaties, land cessations, and executive orders. Of the 16 Tribes with interests on the Custer Gallatin National Forest, only the Crow share common boundaries with the national forest.

After the 1871 Federal statue eliminated treaty making, the United States continued to make agreements with the Indian Tribes through statues and executive orders. These in essence carry the same weight as treaties (Cohen 1982).

Table 71. Treaty clauses referencing reserved treaty

Tribe*	Treaty	Reserved Rights
Sioux (Dahcotas), Cheyennes, Arapahoes, Crows, Assinaboines, Gros-Ventre Mandans, Arrickaras	"Ft Laramie Treaty with Sioux, Etc. 1851"	*It is, however, understood that, in making this recognition and acknowledgement, the aforesaid Indian nations do not hereby abandon or prejudice any rights or claims they may have to other lands; and further, that they do not surrender the privilege of hunting, fishing, or passing over any of the tracts of country heretofore described.*
Sioux—Brulé, Oglala, Miniconjou, Yanktonai, Hunkpapa, Blackfeet, Cuthead, Two Kettle, Sans Arcs, and Santee—and Arapaho"	"Treaty with the Sioux—Brulé, Oglala, Miniconjou, Yanktonai, Hunkpapa, Blackfeet, Cuthead, Two Kettle, Sans Arcs, and Santee—and Arapaho" (Ft Laramie Treaty 1868)	*reserve the right to hunt on any lands north of North Platte, and on the Republican Fork of the Smoky Hill River, so long as the buffalo may range thereon in such numbers as to justify the chase*.
Crow	Treaty with the Crows, 1868	*. . . they shall have the right to hunt on the unoccupied lands of the United States so long as game may be found thereon, . . .*
Confederated Tribes of the Flathead, Kootenay, and Upper Pend d' Oreilles	Treaty with the Flatheads, etc. "Hellgate Treaty" 1855	The exclusive right of taking fish in all the streams running through or bordering said reservation is further secured to said Indians; as also the right of taking fish at all usual and accustomed places, in common with citizens of the Territory, and of erecting temporary buildings for curing; *together with the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land.*
Blackfoot Nation, consisting of the Piegan, Blood, Blackfoot, and Gros Ventres Tribes of Indians. West of the Rocky Mountains, the Flathead Nation, consisting of the Flathead, Upper Pend d'Oreille, and Kootenay Tribes of Indians, and the Nez Percé tribe	Treaty with the Blackfeet, 1855	exclusive right of taking fish in all the streams where running through or bordering said reservation is further secured to said Indians: as also the right of taking fish at all usual and accustomed places in common with citizens of the territory, and of erecting temporary buildings for curing, *together with the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land.*
Nez Perce tribe of Indians "*occupying lands lying partly in Oregon and partly in Washington Territories, between the Cascade and Bitter Root Mountains"*	Treaty with the Nez Perces, 1855	The exclusive right of taking fish in all the streams where running through or bordering said reservation is further secured to said Indians: as also the right of taking fish at all usual and accustomed places in common with citizens of the territory, and of erecting temporary buildings for curing, together with the privilege of hunting, gathering roots and berries, and pasturing their horses and cattle upon open and unclaimed land.

Tribe*	Treaty	Reserved Rights
Nez Perce	Treaty with the Nez Perce, 1863	agree to reserve all springs or fountains not adjacent to, or directly connected with, the streams or rivers within the lands hereby relinquished, and to keep back from settlement or entry so much of the surrounding land as may be necessary to prevent the said springs or fountains being enclosed; and, further, to preserve a perpetual right of way to and from the same, as watering places, for the use in common of both whites and Indians. … *all the provisions of said treaty which are not abrogated or specifically changed by any article herein contained, shall remain the same to all intents and purposes as formerly, --- the same obligations resting upon the United States, the same privileges continued to the Indians outside of the reservation,*
Northern Shoshone (Eastern and Western Bands) and Bannack	Treaty with the Shoshone (Eastern Band) and Bannack Tribes of Indians, 1868 Fort Bridger Treaty	*they shall have the right to hunt on the unoccupied lands of the United States so long as game may be found thereon,*
Cayuse, Umatilla and Walla Walla Tribes	Cayuse, Umatilla, Walla Walla Treaty, 1855	Provided, also, That the exclusive right of taking fish in the streams running through and bordering said reservation is hereby secured to said Indians, … *the privilege of hunting, gathering roots and berries and pasturing their stock on unclaimed lands in common with citizens, is also secured to them.*
Northern Cheyenne Tribe	Executive Order, 1884	Established the Northern Cheyenne Reservation

*Tribe names displayed as spelled in the treaty

3.12.3 Environmental Consequences

Effects Common to All Alternatives

Numerous laws, executive orders, and regulations govern the relationship and collaboration between American Indian Tribes and the Federal government, represented here by the Custer Gallatin National Forest. Examples of specific legislation designed to identify and protect American Indian sacred, religious and ceremonial sites, traditional cultural properties and uses, and locations of religious importance are noted in previous sections. These laws and policies also govern the use and protection of forest resources that may be of tribal interest or covered by tribal reserved rights. In project planning and implementation, the Forest Service must comply with these laws and regulations and in doing so must meaningfully consult with tribal governments.

The effects to areas of tribal concern are defined by Tribes during consultation. Current management direction and requirements for consultation have been designed to ensure that areas on National Forest System lands that are important to the Tribes are not inadvertently impacted by Forest Service actions. Since management direction is required to follow all Federal laws, policy and regulations in respect to Indian rights and concerns, related effects are the same across all alternatives.

In addition, numerous laws, regulations, and policies govern the use and protection of forest resources that may be of tribal interest or covered under tribal reserved rights. Activities authorized or implement by the Forest Service must comply with these laws regulations and policies which are intended to provide general guidance for the implementation of management practices and for protection of resources, including those of interest to the Tribes. Under National Forest Management Act, the Forest Service is required to provide for the diversity of plant and animal communities and persistence, in the long term, of native species such as bison and bighorn sheep, along with plant species gathered by American Indians. For these reasons, the viability of treaty resources and traditional and cultural species of interest to American Indians would be provided as a result of national forest activities.

Tribal access can be affected by policy decisions, administrative actions, and physical impacts on the ground. Specific concerns from resource management activities such as road building or other modifications on the landscape, could affect tribal members accessing valued places (gathering areas or sacred sites) or practicing cultural activities. While these specific concerns are best addressed at the site-specific level during project or activity planning, restricting access to public lands can have both beneficial and adverse effects on traditional cultural activities. Restricting access may be beneficial when it preserves the solitude and quiet necessary for fasting, prayer, and other ceremonies. It may have a negative effect when it restricts traditional practitioners' ability to collect traditionally important plant, animal, mineral, fossil resources, and teepee poles. Under all revised plan alternatives the main arterial and collector system would remain the same, and this system should provide adequate access to most traditional use areas.

Land allocation decisions such as recommended wilderness and backcountry areas, might impact the reserved rights and interests of Tribes by limiting access to locations used for traditional and ceremonial purposes. Sites of importance to Tribes and many resources of tribal interest are located in remote locations and have been used traditionally for many generations. Designating these areas as recommended wilderness or backcountry areas may limit or impair access to these sites by motorized means, but would not deter the ability of Tribes to continue to conduct ceremonies and gather resources in traditional ways.

Conversely, designating areas as recommended wilderness or backcountry areas may afford those locations with significant protections that could prevent inappropriate access and damage to sacred sites while preserving these traditional and cultural landscapes.

The amount of land in recommended wilderness or backcountry areas (low development areas in the current plans) varies by alternative as described for each alternative.

Current Plans

Management Direction under the Current Plans

Native American religious practices areas were recognized in at least one area on the Custer National Forest that is used by Tribes for the practice of traditional religious activities, and there is a recognition that there may be other areas as yet undisclosed. It provides the Custer Gallatin with specific direction for the management of these areas. Continued coordination with the Tribes was mandated to avoid loss of the areas' value for continuation of the traditional uses.

A number of low development areas were identified in the plan including the Cook Mountain, King Mountain, and Tongue River Breaks on the Ashland District. A management area “J” was defined as a low development for the King Mountain, Cook Mountain, and Tongue River Breaks with direction to take into account Native American Concerns in management of the area and to establish a consultation process to assess Northern Cheyenne views on activities that might affect ancestral cultural sites. Further, the area is to be managed to assure compliance with the American Indian Religious Freedom Act. The current plans have about 34,000 acres of recommended wilderness area.

For both forest plans, consideration was taken in regard to complying with Federal and State laws, and to include tribal groups in consultation if a site appears to have religious or historical significance. The reburial policy appears to be a precursor to Native American Graves Protection and Repatriation Act and the designation of a special management area for the significant religious use recognizes the importance and respect of this activity before the terms traditional cultural property was defined.

The plans predate the passage of the Native American Graves Protection and Repatriation Act (NAGPRA) and the 1992 amendment to the National Historic Preservation Act (NHPA); the latter calls attention to procedures for the identification of traditional cultural properties. While the current plans predate the passage of these laws, the Forest Service must follow these laws under the current plans.

Effects of the Current Plans

Under the current plans, the Tongue River Breaks cultural landscape and traditional use locations are afforded protection and access to the resources by the Tribe. The North Cave Hills, South Cave Hills, Slim Buttes, and Chalk Buttes in the Sioux Geographic Area, the Pryor Mountains, and Crazy Mountains’ traditional cultural landscapes and traditional cultural use locations, Ludlow Cave and Dryhead Overlook are not afforded additional land allocations.

The current plans have no plan direction for bison, although would continue bison management in conjunction with partners under the Interagency Bison Management Plan.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

Forest wide plan components, for all revised plan alternatives, recognize culturally significant species and habitats; availability of forest resources for collection by tribal members with treaty rights and tribal member access to sacred; religious and ceremonial sites and landscapes. In addition, plan components recognize traditional use areas of the North Cave Hills, Chalk Buttes, Tongue River Breaks, and Pryor Mountains.

Effects Common to the Revised Plan Alternatives

All revised plan alternatives contain plan components that explicitly state the desired conditions for cultural and tribal resources and provide guidance for achieving these desired conditions. Collectively, these plan components serve to ensure that potential adverse effects from land management activities are avoided or minimized. The revised plan alternatives also contain plan components designed to ensure reserved treaty rights are considered in management decisions and to provide access to the Custer Gallatin for traditional, religious, and ceremonial uses. Because all revised plan alternatives have the same plan components for areas of tribal Interest and management, direction is required to follow all Federal laws and regulations in respect to American Indian rights and interests, related effects are the same across all revised plan alternatives.

Vegetation treatment may help the restoration of vegetation to desired conditions, which consider historical vegetation and future climate. While ground disturbing in the short run, the restoration may contribute to the enhancement, preservation, protection, and continued use of forest resources by the Tribes. Teepee pole collection opportunities are available in all revised plan alternatives since vegetation and fuels treatment activities are geared toward moving vegetation toward desired conditions.

The revised plan alternatives also emphasize collaborating with tribal partners to ensure continued access to sacred, religious and ceremonial sites, and traditional use areas. While Tribes may traditionally have reached these places by foot or horseback, today, motorized vehicles are essential for reaching some locations, especially for elders who can no longer walk long distances. The Custer Gallatin would consult with Tribes when access and recreation management activities may impact treaty rights or cultural sites and cultural use. There is some potential risk to sacred sites where American Indians conduct ceremonies that require privacy. If a road were built to or near such a site, the associated increase in visitation could make it difficult to conduct ceremonies there, undermining the important cultural practice.

The North Cave Hills, South Cave Hills, and Slim Buttes have been identified through tribal resolutions as sacred sites within the Sioux Geographic Area. There is still a potential that landscape integrity and sacred sites may be affected because of the activities that are permitted under the revised plan alternatives. However, prior to implementing resource management activities impacts on tribal government and tribal practices would be assessed and consultation requirements fulfilled.

Effects of Alternatives B and C

Under these two alternatives, the allocations of backcountry areas for locations in the Pryor Mountains, the Tongue River Breaks, and the Crazy Mountains (under alternative C) afford continued traditional use and access to these locations while protecting the traditional cultural landscape from over use and inappropriate additional motorized access. Under the backcountry areas designation, no new roads, energy or utility corridors, new commercial communication sites, new salable mineral material extraction, or developed recreation sites would be established. By making these units backcountry areas, access to traditional resources and uses is maintained, although restricting motorized and mechanized recreation use in the Pryor Mountains backcountry areas in alternative C may restrict some methods of access for tribal members.

No additional land allocation, such as backcountry areas or recommended wilderness, is proposed for North Cave Hills, Slim Buttes, or Chalk Buttes (Sioux Geographic Area) under these alternatives, although plan components recognize traditional use areas of the North Cave Hills and Chalk Buttes.

Effects of Alternative D

Alternative D would add the largest number and greatest acreage of new areas recommended for addition to the National Wilderness Preservation System. Desired conditions for proposed wilderness such as naturalness and opportunities for solitude; untrammeled and undeveloped landscapes; where natural ecological processes and disturbances continue with limited amount of human influence meet the same characteristics needed for sacred sites and traditional landscapes.

The Crazy Mountains and Tongue River Breaks backcountry area land allocation under alternatives B and C become recommended wilderness areas, preserving the natural setting, and protecting and enhancing the traditional cultural landscape use and values. The Pryor Mountains would change from a backcountry area land allocation to an expanded recommended wilderness area that includes the Pryor Mountain Wild Horse territory. This designation would contribute to the preservation and protection of this traditional cultural use areas, landscape and protect the Dryhead Overlook traditional cultural property. The Chalk Buttes becomes a backcountry area which affords this traditional cultural use area additional protection from new roads, utility corridors, commercial communication sites, new salable mineral material extraction, and developed recreation sites while allowing access for traditional cultural activities.

While many tribal activities could still occur within areas recommended for wilderness, some activities such as gathering and ceremonial uses may be restricted or more difficult due to decreased access. No additional land allocation is proposed for the North Cave Hills or Slim Buttes sacred sites, although plan components recognize traditional use areas of the North Cave Hills.

Effects of Alternative E

No areas within the Chalk Buttes, North Cave Hills or Slim Buttes in the Sioux GA; the Tongue River Breaks in the Ashland Geographic Area; the Pryors Geographic Area; or the Crazy Mountains in the Bridger, Bangtail, and Crazy Mountains Geographic Area are identified for any additional land allocations. These traditional cultural landscapes and sacred areas characteristics may be detrimentally affected by the possibility of new roads, utility corridors, commercial communication sites, new salable mineral material extraction, and developed recreation sites. Traditional cultural areas that are currently accessible and used by Tribes would continue, however, increased access and potential for ground disturbing activities within the traditional cultural landscapes of the Pryors, Tongue River Breaks, Chalk Buttes, Slim Buttes, North Cave Hills, and the Crazy Mountains may introduce visual, atmospheric, or audible elements that can diminish the integrity of traditional use sites, sacred sites and landscapes. Plan components require that new developments and land management activities to avoid, minimize, and mitigate potential conflict with forest resources used for traditional cultural practices. All Forest Service management activities on national forest lands are required to meet applicable environment protection measures as required by law, regulation, and policy —compliance with these measures would ensure that areas of tribal importance would be taken into consideration.

Consequences to Areas of Tribal Interest from Forest Plan Components Associated with Other Resource Programs or Management Activities

Effects from Vegetation Management

Desired conditions for vegetation components have been largely based on their natural ranges of variability (NRV) which reflect conditions prior to Euro-American settlement. For all alternatives, managing vegetation toward or within desired conditions should provide diverse and sustainable habitat conditions for plant and animal species similar to those that existed for traditional hunting and gathering, a right reserved through a number of treaties.

Teepee poles and Sundance poles and materials are extremely important forest products to the Tribes. Collection is currently administered in recognition of tribal rights to gather these materials under the 1968 Fort Laramie Treaty. As more demand for these cultural materials increases, the Custer Gallatin National Forest will be tasked to find additional locations for tribal use. Forest Service practices management decisions or land allocations that may diminish the quantity and quality, or access to these resources. While vegetation treatments may be ground disturbing, these practices under all alternatives may offer opportunities for identification of potential teepee pole patches and providing increased access to these resources.

Effects from Fire and Fuels Management

Fire suppression techniques such as fire line construction could impact cultural resources. However, under all alternatives, minimum impact suppression tactics (MIST) would be used to prevent damage to culturally sensitive areas. Surveys are completed before implementation of mechanical fuels treatments and prescribed fires to ensure that there are no impacts to cultural sites. Prescribed burning and wildfire, under the right conditions, may increase the propagation of certain tree and grass species that have traditional use. Wildland fire may also uncover previously unknown sites by clearing ground fuels.

Effects from Wildlife Management

Detrimental effects to bison and bighorn sheep habitat and the availability and access to these traditional resources were identified as concerns by most of the Tribes.

Specific bison components have been designed in recognition of the unique nature of the Yellowstone bison population and the importance of this population to the Tribes and their off-reservation treaty rights. Plan components include management actions that would not limit bison expansion into unoccupied suitable habitat and access to forage. These components accommodate bison migrating out of Yellowstone Park in winter as well as supporting year round bison presence on the Custer Gallatin. The improvement and range of bison habitat ensures species viability and the ability of tribal members to exercise their rights for traditional hunting under their respective treaties. It also helps to restore Tribal cultural continuity and reconnection to their ceremonial lifeway pertaining to bison.

A range of approaches is presented in the alternatives. Both alternatives B and C are proactive for bison management on the Custer Gallatin. Alternative D is the most proactive by providing for year round occupancy in sufficient numbers and adequate distribution to provide a self-sustaining population on the Custer Gallatin. Alternative D also includes vegetation management activities designed to maintain or improve bison habitat suitability and connectivity. Alternative

E is the least proactive in terms of promoting bison habitat with no objective to improve bison habitat and in instances of bison-livestock conflicts, management actions resolutions would favor livestock.

Current forest plans and allotment management plans for most Custer Gallatin National Forest allotments identify and manage for wildlife forage needs, such as crucial winter range and limiting interactions between livestock and bighorn sheep to avoid disease transmission. Alternatives B, C, and E would require a risk assessment for potential disease transmission before permitting domestic sheep and goat grazing, agency use for weed control, or for permitted recreational goat packing, in all or parts of the Custer Gallatin. Alternative D would not allow new permitted domestic sheep and goat grazing or permitted recreational goat packing or agency use of goats or sheep for weed control.

Effects from Recreation Management

Recreation use on the Custer Gallatin National Forest has seen a marked rise for the last 40 to 50 years. Some of the places most sought after are also culturally, spiritually, and economically vital to Native American Tribes. As more people take to these lands to hike, bike, climb, ski, paddle, or camp, respect for indigenous values sometimes fades. Recreation can potentially affect tribal resources through its effects on both ground disturbance and visitor use. Ground disturbance may occur either directly, through the construction and management of recreation sites, or indirectly, through the use of motor vehicles for recreation. All revised plan alternatives contain plan components designed to avoid or mitigate these effects. New roads, campsites, trails, and other recreation infrastructure would be designed in a way that minimizes any adverse effects from construction and protects cultural, traditional and historical resources from the effects of future visitor use.

The Custer Gallatin National Forest manages portions of Nez Perce Trail, which have significant cultural and traditional value to the Nez Perce Tribe. Plan components associated with management of this trail ensures that they conserve important cultural values while allowing visitors an opportunity to learn about the local history. The Nez Perce National Historic Trail, which traces the 1877 flight of the Nez Perce from their traditional lands holds historical and cultural significance for the Nez Perce and other Tribes.

Effects from Energy and Minerals Management

Activities such as mineral, oil, and gas exploration and development, construction of transmission lines, railroad spurs, pipelines, and utility corridors have the potential to affect areas of tribal importance. Introduction of visual, atmospheric, or audible elements from oil and gas wells can diminish the integrity of traditional use sites, sacred sites, and landscapes.

Other energy development and technology developments not necessarily linked to mineral development also can affect traditional cultural uses. Alternative energy development such as wind power can result in a large footprint on the landscape and often impact viewshed, which can be so integral to fasting and vision quest activities. Telecommunication towers are often located on high points such as mountaintops and if 200 feet in height are required by the Federal Aviation Administration to be lit at night. This causes visual intrusions to the traditional cultural landscapes and possibly displacing traditional cultural practices.

All mineral and energy management activities on national forest lands are required to meet applicable environment protection measures as required by law, regulation, and policy — compliance with these measures would ensure that areas of tribal importance would be taken into consideration.

The specific plan component for the Stillwater Complex in recognition of its unique geographic exposure, ore grade and scale of mineral deposits should have little effect to areas of tribal importance since consideration of this effect is mandated by law, regulation, and policy.

Effects from Permitted Livestock Grazing Management

Livestock can contribute to the deterioration of cultural and historical resources through physical contact (For example, hoof action, rubbing on structures) or by contributing organic matter to a site. They can remove or alter vegetation that protects sites from erosion and make these resources more visible for unauthorized collection. In cases where the level of impact is unacceptable, the impacts can be mitigated with fencing or with changes in management (intensity or timing). Under all alternatives, plan components are in place to ensure the protection of cultural and historic sites and resources. The potential for these effects is the same for all alternatives.

Plan components for permitted grazing would avoid, minimize, or mitigate adverse livestock-related impacts to traditionally significant plant species through appropriate design of grazing practices (such as stocking levels, duration, timing), and physical structures (such as off-site water developments or hardened stream crossings). In doing so, this promotes resiliency of riparian and upland ecosystems, and associated flora. To date, detrimental effects from current management within known plant collection areas such as Commissary Ridge in the Pryor Geographic Area, Tongue River Breaks in the Ashland Geographic Area, and the higher elevations of the Chalk Buttes (Sioux Geographic Area) have not been identified by the Tribes.

A common activity associated with range management is the development of springs on forest lands. For some Tribes like the Northern Cheyenne, springs are associated with spirit life and development may cause the spirit to move away, no longer being available to those who visit the spring for traditional cultural purposes (Deaver and Kooistra-Manning 1995). Plan components designed for the Chalk Buttes on the Sioux Geographic Area and Tongue River Breaks in the Ashland Geographic Area call for new spring developments to avoid springs used for traditional cultural purposes to minimize conflicts with traditional cultural practices.

Effects from Land Status and Ownership Management

Land exchanges, sales, and land transfers may have adverse impacts to treaty Tribes that retained off-reservation treaty rights. Cultural resources located on many off-reservation lands are essential to the culture and traditions of the Tribes and are held in trust by the Federal Government. Access to these areas is essential for tribal members to exercise their treaty rights. These land actions may extinguish these rights when transferred to a private entity. Under all alternatives, Federal law requires consultation with Tribes prior to consideration of such land sales or transfer. This consultation is essential to honoring these treaty rights.

Cumulative Effects

Tribes, tribal groups and organizations, and traditional cultural practitioners depend on the land and resources that cross multiple jurisdictions and ecosystems. Much of the lands in the planning area are managed by Federal land management agencies —other national forests, national parks, and Bureau of Land Management managed lands— which all have requirements for Government-to-Government meetings with Tribes to consult and coordinate management of the land and resources (to meet tribal and agency responsibilities). Land and resource management under the forest plan is generally complementary with management across the Federal agencies regarding tribal relations and uses.

Conclusion

All alternatives would continue the important Government-to-Government meetings for activities that may affect sacred, religious and ceremonial sites, traditional use areas, and treaty resources including wildlife, fish and plant habitats. Revised plan alternatives include additional plan components that protect and in some cases enhances areas of tribal concern, and improves the integration of tribal interests into project planning. These alternatives would provide for increased opportunity to improve access to and use of resources important to Tribes, and traditional cultural practitioners, compared to the current plan.

Access to sacred sites, traditional resources and traditional cultural resources is also a key issue for Tribes. While some alternatives may restrict access through certain land allocations, the Custer Gallatin staff would collaborate with Tribes to accommodate access to and ceremonial use of sacred sites under all alternatives.

Alternative E would have the least impact to access to sites and resources currently used by Tribes, and traditional cultural practitioners since no areas would be recommended for wilderness designation. Increased access however, may introduce inappropriate visitation and use to locations of traditional use, traditional landscapes, and sacred sites. Increased ground disturbance also has the potential to damage these traditional places. Alternative D would have the most potential impact because access to and use of areas may create additional barriers for tribal members, while protecting the traditional landscapes and setting. For alternatives B and C, the allocations of backcountry areas (for locations in the Pryor Mountains, the Tongue River Breaks, and the Crazy Mountains (under alternative C)) would afford continued traditional use and access to these locations. The backcountry allocations (in alternatives B and C) would also protect the traditional cultural landscape from over use and additional motorized access. Although, restricting motorized and mechanized recreation use in the Pryor Mountains backcountry area in alternative C may restrict some methods of access for tribal members.

Both alternatives B and C are proactive for bison management on the Custer Gallatin National Forest. Alternative D would provide the most proactive management for bison presence on the national forest, and alternative E would provide the least proactive bison management.

3.13 Cultural and Historic Resources

3.13.1 Introduction

Cultural resources can be defined as physical evidence or places of past human activity: site, object, landscape, structure; or a site, structure, landscape, object or natural feature of significance to a group of people traditionally associated with it. As defined in Forest Service Manual 2360, they is "an object or definite location of human activity, occupation, or use identifiable through field survey, historical documentation, or oral evidence." This includes prehistoric and historic archaeological sites and districts; historic buildings and structures; ethnographic landscapes; and traditional cultural properties. Traditional cultural properties are defined as a cultural resource that is eligible for inclusion in the National Register of Historic Places because of its association with cultural practices or beliefs of a living community that are rooted in that community's history, and important in maintaining the continuing cultural identity of the community. It must also be a tangible property; that is, a district, site, building, structure, or object.

Cultural resources also include a substantial record of oral histories, photographs, maps, reports, and archaeological artifacts. The documentary record of the people and historical landscapes that are illustrated in these old stories, maps and photographs contribute greatly to the understanding of cultural resources on the Custer Gallatin.

The public's recognition that these non-renewable resources are important and should be protected began very early in this century and continues to the present through a myriad of Federal laws, regulations, and policies that direct the documentation and management of cultural resources. Maintaining the scientific, historic, and social integrity of these resources provides a vital link of our collective past to the present.

Cultural resources are significant social and economic contributors to the Custer Gallatin National Forest, region, and nation. They provide opportunities for cultural tourism, education and research. They are also necessary for maintaining the cultural identity of the traditional communities such as the tribal, mining and ranching publics within and adjacent to the Custer Gallatin.

Regulatory Framework

Since these resources are nonrenewable and easily damaged, laws and regulations exist to help protect them. Pertinent laws and regulations governing the management of cultural resources of the Custer Gallatin can be separated into laws, executive orders, and regulatory and guidance related categories. Pertinent laws and regulations include:

Organic Act of 1897 (Title 16, United States Code (U.S.C.), section 473-478, 479-482, 551): is the original organic act governing the administration of National Forest System lands. It is one of several Federal laws under which the Forest Service operates. Under this act, the secretary of agriculture may make regulations and establish services necessary to regulate the occupancy and use of National Forest System lands and preserve them from destruction. Persons violating the act or regulations adopted under it are subject to fines or imprisonment. The Organic Act is one authority used to issue permits for archaeological investigations.

Antiquities Act of 1906 (16 U.S.C. 431): provides for permits, for misdemeanor-level penalties for unauthorized use, and for presidential designation of national monuments for long-term preservation. The Archaeological Resources Protection Act has replaced the Antiquities Act as the authority for special use permits if the resource involved is 100-years-old or greater. Uniform regulations at 43 Code of Federal Regulations (CFR) part 3 implement the act.

Historic Sites Act of 1935 (16 U.S.C. 461): declares national policy to "preserve for public use historic sites, buildings, and objects of national significance for the inspiration and benefit of the people of the United States." The act authorizes the National Park Service's National Historic Landmarks Program. The National Historic Landmarks Program is implemented by regulations at 36 CFR part 65.

National Historic Preservation Act of 1966 (NHPA) (16 U.S.C. 470), as amended: extends the policy in the Historic Sites Act to State and local historical sites as well as those of national significance, expands the National Register of Historic Places, establishes the Advisory Council on Historic Preservation and the State Historic Preservation Officers, and requires agencies to designate Federal Preservation Officers. National Historic Preservation Act Section 101(d)(2) establishes criteria for designating Tribal Historic Preservation Officers to assume the functions of a State Historic Preservation Officer on Tribal lands. National Historic Preservation Act Section 106 directs all Federal agencies to take into account the effects of their undertakings (actions, financial support, and authorizations) on properties included in or eligible for the National Register. Advisory Council on Historic Preservation regulations at 36 CFR part 800 implement National Historic Preservation Act Section 106. National Historic Preservation Act Section 110 establishes inventory, nomination, protection, and preservation responsibilities for federally owned historic properties.

National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321-4346): establishes national policy for the protection and enhancement of the environment. Part of the function of the Federal government in protecting the environment is to "preserve important historic, cultural, and natural aspects of our national heritage." The act is implemented by the Council on Environmental Quality (CEQ) regulations at 40 CFR 15001508.

The Archeological and Historic Preservation Act of 1974 (AHPA) (16 U.S.C. 469): is also known as the Archeological Recovery Act and the Moss-Bennett Bill. Archeological and Historic Preservation Act amended and expanded the Reservoir Salvage Act of 1960 and was enacted to complement the Historic Sites Act of 1935 by providing for the preservation of historical and archaeological data, which might be lost or destroyed as the result of the construction of a federally authorized dam or other construction activity. This greatly expanded the number and range of Federal agencies that had to take archeological resources into account when executing, funding, or licensing projects. Archeological and Historic Preservation Act also allows for any Federal agency responsible for a construction project to appropriate a portion of project funds for archaeological survey, recovery, analysis, and publication of results.

Forest and Rangeland Renewable Resource Planning Act of 1974 as amended by the National Forest Management Act (NFMA) of 1976: requires that "public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition..."

Federal Land Policy and Management Act of 1976 (FLPMA), (43 U.S.C. 1701), directs the Forest Service to manage National Forest System (NFS) lands on the basis of multiple use, in a manner that “recognizes the nation’s need for domestic sources of minerals, food, timber, and fiber from the public lands” and that will “protect the quality of …historical…resources, and archeological values.” The act provides for the periodic inventory of public lands and resources, for long-range, comprehensive land use planning, for permits to regulate the use of public lands, and for the enforcement of public land laws and regulations. Federal Land Policy and Management Act compels agencies to manage all cultural resources on public lands through the land management planning process.

National Forest Management Act of 1976 (NFMA) (16 U.S.C. 1600): directs the Forest Service to develop renewable resource plans through an interdisciplinary process with public involvement and consultation with other interested governmental departments and agencies.

The American Indian Religious Freedom Act (AIRFA) of 1978: American Indian rights to exercise traditional religions including access to sites and freedom to worship through ceremonials and traditional rights are protected by this act.

Archaeological Resources Protection Act of 1979 (ARPA) (16 U.S.C. 47Oaa et seq.), as amended: provides criminal penalties (felony and misdemeanor) and civil penalties for the unauthorized excavation, removal, damage, alteration, defacement, or the attempted unauthorized removal, damage, alteration, or defacement of any archaeological resource, more than 100 years of age, found on public lands or Indian lands. The act includes National Forest System lands in its definition of public lands. The act also prohibits the sale, purchase, exchange, transportation, receipt, or offering of any archaeological resource obtained from public lands or Indian lands in violation of any provision, rule, regulation, ordinance, or permit under the act, or under any Federal, State, or local law. No distinction is made regarding National Register of Historic Places eligibility. The act establishes permit requirements for removal or excavation of archaeological resources from Federal and Indian lands. The act further directs Federal land managers to survey land under their control for archaeological resources and create public awareness programs concerning archaeological resources. Uniform regulations and departmental regulations at 36 CFR part 296 implement Archaeological Resources Protection Act.

Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) (25 U.S.C. 3001): provides a process for museums and Federal agencies to return certain Native American cultural items – human remains, funerary objects, sacred objects, or objects of cultural patrimony – to lineal descendants, and culturally affiliated Indian Tribes and Native Hawaiian organizations. Native American Graves Protection and Repatriation Act includes provisions for unclaimed and culturally unidentifiable Native American cultural items, intentional excavation and unanticipated discovery of Native American cultural items on Federal and Tribal lands, and penalties for noncompliance and illegal trafficking. The act requires agencies and museums to identify holdings of such remains and objects and to work with appropriate Native American groups toward their repatriation. Permits for the excavation or removal of “cultural items” protected by the act require tribal consultation, as do discoveries of “cultural items” made during activities on Federal or Tribal lands. The secretary of the interior’s implementing regulations are at 43 CFR part 10.

Federal Lands Recreation Enhancement Act of December 8, 2004, (REA) (16 U.S.C. 6801-6814) permits Federal land management agencies to charge modest fees at recreation facilities that provide a certain level of visitor services. Federal Lands Recreation Enhancement Act also permits fees for specialized recreation permits necessary when recreation activities require exceptional visitor safety measures, extraordinary natural and cultural resource protection, or dispersal of visitors to ensure that good experiences are sustainable. Federal Lands Recreation Enhancement Act includes provisions that require the use of Recreation Resource Advisory Committees to provide the public with information about fees and how fee revenues will be used. The primary goal of Federal Lands Recreation Enhancement Act is to enhance visitor facilities and services to provide a quality recreation program.

Other Acts such as Multiple-Use Sustained-Yield Act of 1960 (16 U.S.C. 528-531) and the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) (17 U.S.C. 1600-1674)): includes authorities that establish national forest management direction and thereby may affect Heritage Program activities.

Executive Order 11593 - Protection and enhancement of the cultural environment, issued May 13, 1971: directs Federal agencies to inventory cultural resources under their jurisdiction, nominate all federally owned properties that meet the criteria to the National Register of Historic Places, use due caution until the inventory and nomination processes are completed, and assure that Federal plans and programs contribute to preservation and enhancement of non-federally owned properties.

Executive Order 13007 - Indian Sacred Sites, issued May 24, 1996: directs Federal land management agencies, to the extent permitted by law, and not clearly inconsistent with essential agency functions, to accommodate access to and use of Indian sacred sites, to avoid affecting the physical integrity of such sites wherever possible, and, where appropriate, to maintain the confidentiality of sacred sites. Federal agencies are required to establish a process to assure that affected Indian Tribes are provided reasonable notice of proposed Federal actions or policies that may affect Indian sacred sites.

Executive Order 13175 - Consultation and Coordination with Indian Tribal Governments: issues November 6, 2000, directs Federal agencies to establish regular and meaningful consultation and collaboration with Tribal officials in the development of Federal policies that have tribal implications, to strengthen the United States government-to-government relationships with Indian Tribes, and to reduce the imposition of unfunded mandates upon Indian Tribes. Public Law (P.L.) 108-199 and 108-477 added language that directed the Office of Management and Budget and all Federal agencies to consult with Alaska Natives and Alaska Native Corporations on the same basis as Indian Tribes under Executive Order 13175.

Executive Order 13287 - Preserve America, issued March 3, 2003: establishes Federal policy to provide leadership in preserving America’s heritage by actively advancing the protection, enhancement, and contemporary use of the historic properties owned by the Federal government. The order encourages agencies to seek partnerships with State, Tribal, and local governments, and the private sector to make more efficient and informed use of historic properties for economic development and other recognized public benefits. The order requires Federal agencies to review and report on their policies and procedures for compliance with National Historic Preservation Act, Section 110 and 111, improve Federal stewardship of historic properties, and promote long-term preservation and use of those properties as Federal assets contributing to local community economies. The order requires the head of each agency to designate a senior policy official. In addition, it directs the secretary of commerce, working with other agencies, to use existing authorities and resources to assist in the development of local and regional heritage tourism programs.

Executive Order 13327 - Federal Real Property Asset Management, issued February 4, 2004: establishes the Federal Real Property Council to develop guidance for each agency's asset management plan. The senior real property officer of each agency is required to develop and implement an agency asset management planning process that meets the form, content, and other requirements established by the Federal Real Property Council. In relation to cultural resources, the senior real property officer shall incorporate planning and management requirements for historic properties under Executive Order 13287 – Preserve America. Executive Order 13327, para. 2(a) defines "Federal real property" as any real property owned, leased, or otherwise managed by the Federal Government, both within and outside the United States, and improvements on Federal lands.

Executive Order 13007 - Indian Sacred Lands 1996: directs Federal agencies to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites and, where appropriate, to maintain the confidentiality of sacred sites.

Protection of Historic Properties (36 CFR part 800): implements National Historic Preservation Act (NHPA) Section 106 and defines how Federal agencies meet the statutory responsibility to take into account the effects of their undertakings on historic properties. The regulations identify consulting parties as State historic preservation officers, Indian Tribes and Native Hawaiian organizations (including tribal historic preservation officers), representatives of local governments, applicants for Federal assistance, and additional consulting parties. The Advisory Council on Historic Preservation issues these regulations and oversees the operation of the National Historic Preservation Act, Section 106 process. The regulations identify the goal of consultation, which is "to identify historic properties potentially affected by the undertaking, assess its effects, and seek ways to avoid, minimize or mitigate any adverse effects on historic properties" (36 CFR 800.1).

National Register of Historic Places (36 CFR part 60): establishes the National Register of Historic Places (referred to as the National Register for the remainder of this chapter) as a planning tool to help Federal agencies evaluate cultural resources in consultation with State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation (Advisory Council). Regulations 36 CFR 60.4 provides the criteria for determining whether cultural resources are eligible for listing on the National Register of Historic Places.

Protection of Archaeological Resources Uniform Regulations (36 CFR part 296): regulations implement the Archaeological Resources Protection Act by establishing the uniform definitions, standards, and procedures for Federal land managers to follow in providing protection for archaeological resources located on public lands and Indian lands. The regulations define the prohibited acts, which include excavating, removing, damaging, or otherwise altering or defacing archaeological remains; and selling, purchasing, exchanging, transporting, or receiving any archaeological resource that was removed from Federal land in violation of Archaeological Resources Protection Act or any other Federal law. The regulations also provide requirements for issuing permits under the authority of the Archaeological Resources Protection Act to any person proposing to excavate or remove archaeological resources from public lands or Indian lands.

Native American Graves Protection and Repatriation Regulations (43 CFR part 10, Subpart B – Human Remains, Funerary Objects, Sacred Objects, or objects of Cultural Patrimony From Federal or Tribal Lands): carries out provisions of the Native American Graves Protection and Repatriation Act of 1990. The regulations establish a systematic process for determining the rights of lineal descendants and Indian Tribes and Native Hawaiian organizations to certain Native American human remains, funerary objects, sacred objects, or objects of cultural patrimony with which they are affiliated. The regulations pertain to the identification and appropriate disposition of human remains, funerary objects, sacred objects, or objects of cultural patrimony that are in Federal possession or control or in the possession or control of any institution of State or local government receiving Federal funds. The regulations pertain to these objects whether they are inadvertently discovered or excavated intentionally under a permit issued under the authority of the Antiquities Act or Archaeological Resources Protection Act.

Curation of Federally-owned and Administered Archaeological Collections (36 CFR part 79): establishes definitions, standards, procedures, and guidelines for Federal agencies to preserve collections of prehistoric and historic material remains, and associated records recovered under the authority of the Antiquities Act, Reservoir Salvage Act, National Historic Preservation Act, and Archaeological Resources Protection Act.

Planning (36 CFR part 219): sets forth a process for developing, adopting, and revising land and resource management plans for the National Forest System and prescribe how land and resource management planning is to be conducted on National Forest System lands.

Statement of Federal Financial Accounting Standards 29, Heritage Assets and Stewardship Land, July 7, 2005, (SFFAS 29): changes the classification of information reported for heritage assets and stewardship land provided by Statement of Federal Financial Accounting Standards 8. Statement of Federal Financial Accounting Standards 29 reclassifies all heritage assets and stewardship land information as basic except for condition information, which is reclassified as required supplementary information. This standard requires additional reporting disclosures about stewardship policies and an explanation of how heritage assets and stewardship land relate to the mission of the agency.

36 CFR 261 Prohibitions in Areas Designated by Order; Closure of National Forest System Lands to Protect Privacy of Tribal Activities (2011): "provides regulations regarding special closures to provide for closure of National Forest System lands to protect the privacy of tribal activities for traditional and cultural purposes to ensure access to National Forest System land, to the maximum extent practicable, by Indian and Indian Tribes for traditional and cultural purposes."

36 CFR 223.239 and .240 Sale and Disposal of National Forest System Timber, Special Forest Products, and Forest Botanical Products: Section 223.239: provides regulations for free-use without a permit for members of Tribes with treaty or other reserved rights related to special forest products. Also free-use without a permit upon the request of the governing body of a Tribe. Section 223.240 provides regulations regarding harvest of special forest products by Tribes with treaty or other reserved rights.

The following is a list of other documents that authorize and guide the cultural resource management activities on the Custer Gallatin National Forest.

- Forest Service Manual and Handbook (2360) original, revised draft (1986) and final 2008
- National Register Bulletin 38
- Montana Programmatic Agreement between the Advisory Council for Historic Preservation, the Montana State Preservation Office, and the Northern Region of the U.S. Forest Service (2015) regarding negative inventory and no historic properties affected undertakings in the State of Montana by the USDA Forest Service.
- South Dakota Programmatic Agreement between the Advisory Council for Historic Preservation, the South Dakota State Historic Preservation Office and the Northern Region of the U.S. Forest Service (1996) regarding cultural resource management on national forests in the northern region in the State of South Dakota.
- Programmatic Agreement among the Custer National Forest, the Bureau of Land Management Montana State Office, the Advisory Council for Historic Preservation, the South Dakota State Historic Preservation Officer, the Cheyenne Sioux Tribe, the Standing Rock Sioux Tribe, the Lower Brule Sioux Tribe, the Rosebud Sioux Tribe and the Mandan, Hidatsa and Arikara Nation regarding the identification, evaluation, and treatment of properties and cultural resources of traditional religious and cultural importance and significance affected by oil and gas leasing and development on the Custer National Forest, Sioux District (2007).
- Heritage Program managed to standard performance measures, 2011
- National Historic Preservation Act Programmatic Agreement regarding the maintenance of historic buildings by the Northern Region Historic Preservation Team, 1992, as amended 2015.

Key Indicators and Measures

Forest Management activities have the potential to affect cultural resources through the potential for ground disturbance to adversely affect cultural resources; additional cultural resources recorded through increased inventory prescribed by law, regulation, and/or policy; and change of access to sites.

Key indicators used to evaluate the effects of alternatives are:

- The amount of vegetation management related ground disturbance that might occur under each alternative, measured in projected vegetation management acres.

- Potential increase or decrease in access to cultural resources, measured in relative amount of land in recommended wilderness and backcountry area land allocations.

Methodology and Analysis Process

The projected amount of vegetation management is used as an analysis indicator due to the potential for ground disturbance to adversely affect cultural resources.

Cultural resource inventories have generally occurred in areas where there have been management activities in response to vegetation and fuels treatment, mineral developments, range assessments, recreational development, special uses, and engineering projects. Therefore, relative levels of these activities in the alternatives would influence the number of new cultural resources recorded that would require evaluation, protection, and interpretation. They would add to the understanding of cultural resources on the Custer Gallatin. When heritage resource inventories in response to projects would be reduced, there is an increased potential for presently unknown cultural resources to be lost, damaged or exposed from naturally occurring erosion and wildfire, and less opportunity to contribute to the site record and understanding of the cultural resources in these areas. Projected amount of vegetation management is used as an analysis indicator of future cultural resource inventory areas because objectives are included for this activity.

Potential increase or decrease in access to cultural resources is used as an analysis indicator because increased access could lead to detrimental effects such as vandalism and looting, while in areas where sites are less accessible, effects to cultural resources can result from neglect, leading to deterioration or potential vandalism. Increased access may also have a positive impact on cultural and historical resources if it increases the rate of discovery of new cultural or historical sites. Amount of recommended wilderness areas and backcountry areas are measured because these land allocations do not allow new permanent roads, and in some areas affect existing summer mechanized or motorized recreation access. It is assumed that oversnow travel does not affect cultural resources.

It is not possible to evaluate the impacts of alternatives on specific cultural sites because the programmatic nature of a forest plan does not predict the exact locations of future activities.

Information Sources

Information sources included published sources, site and report records, corporate geographic information system (GIS), INFRA, and NRM databases relevant to the Custer Gallatin. Additional documents include a number of historic and cultural overviews see Cultural and Historic Resources and Uses Assessment Report (La Point and Bergstrom 2017).

Analysis Area

The analysis area is primarily related to the resources on the Custer Gallatin, within the context of the thousands of years of pre-contact history and hundreds of years of post-contact history of the Northern Rocky Mountains and Great Plains. The temporal scope of the effects analysis is the anticipated life of the plan.

3.13.2 Affected Environment (Existing Condition)

The Custer Gallatin contains one of the richest and most diverse series of Pre-contact (prehistoric) sites in North America, due in large measure to the remarkable diversity of land forms and ecology which occurs within the far flung boundaries of the Custer Gallatin National Forest. This diverse landscape also supported a remarkable variety of American Indian Tribes during contact (historic) period as tribal oral histories and historic documents attest. Over the last 100 years, land use practices such as logging, mining, grazing, recreation, road systems, policies of fire suppression, and establishment of Indian reservations have changed or altered heritage resources in the planning area. These changes have contributed to the development of the historical landscape as seen and experienced today.

Since the late 1970s, parts of the Custer Gallatin have been systematically inventoried for cultural resources in response to National Historic Preservation Act regulations. However, only about 222,000 (7.4 percent) of the national forest’s 3 million acres have been inventoried. Usually occurring as part of unrelated management activities such as vegetation and fuels treatments, recreation development, oil and gas development, mine expansion and reclamation, rangeland management and engineering projects.

From these inventories a wide variety of cultural and historical sites themes, including pre-contact civilization, American Indian use, tribal and U.S. government conflict, mining, agricultural development, ranching, timber, transportation, homesteads, local settlement, fire detection, recreation, Civilian Conservation Corps projects, and Forest Service administrative history.

As of July 2016, the Custer Gallatin had more than 4,360 cultural resources listed in the Forest Service’s database. Of these cultural resources, 48 are listed on the National Register, 541 are eligible for nomination and 176 have been found to be not eligible. This leaves 3,595 sites, or 83 percent of the sites in the database, that have not been evaluated for National Register eligibility. Site evaluation would aid properly preserve and protect these resources and also discover what significant information related to the prehistory and history of the Custer Gallatin they may hold. In reference to the National Historic Preservation Act, the unevaluated sites are considered eligible for nomination to the National Register until their eligibility status is determined.

Pre-contact, or prehistoric, sites represent the majority of the identified recorded sites, accounting for 76 percent of the Custer Gallatin’s total. Historic sites comprise 22 percent of the historic properties on the Custer Gallatin, and multicomponent sites, sites displaying both historic and prehistoric elements sharing a common area, make up 2 percent of the Custer Gallatin total. The different environments and land use between east and west districts can be seen with the number of mining sites—the west districts have 169 while the east has five sites, and homestead sites, there are 61 sites on the east districts and eight on the west districts.

The Custer Gallatin National Forest has 48 sites—5 individual and 43 as multiple listings—listed on the National Register of Historic Places as of August 2016, and two proposed Districts. There is also one National Historic Trail. These include:

- The OTO Homestead and Dude Ranch (24PA1227)
- Prehistoric Rock Art of South Dakota Multiple Listing Nomination

- Camp Senia Historic District, and 2015 Boundary Expansion (24CB1134)
- Rock Creek Ranger Station (24CB1198)
- Red Lodge-Cooke City Approach Road (includes segment of the Beartooth Scenic Byway); 24CB1964, 24PA1255, 48PA2310
- Lightning Springs (39HN204)
- Nez Perce National Historic Trail
- North Cave Hills Archaeological and Traditional Use District
- Crazy Mountains Traditional Cultural Property District (Proposed)
- Civilian Conservation Corps Roads on the Ashland and Beartooth Districts, Multiple Property Listing
- Dryhead Overlook District (Proposed)

In addition to these national register sites are three proposed traditional cultural landscapes, the Pryor Mountains, the Tongue River Breaks on the Ashland Geographic Area, and the Chalk Buttes Unit on the Sioux Geographic Area. There are also at least five identified traditional cultural property locations.

“Priority assets” is a special Forest Service category of sites that demonstrate a distinct value to the Custer Gallatin and are actively maintained and monitored every five years. There are 341 priority assets currently identified on the Custer Gallatin.

The Custer Gallatin has put significant effort into the restoration of many historic cabins for either continued administrative use or for public use as rental cabins. Examples of administrative use cabins include Meyers Creek, Sage Creek Cabin, Buffalo Forks Guard Station, Main Boulder, and Rock Creek Station. Examples of rental cabins include Basin Creek Ranger Station, Four Mile Guard Station, Diamond Butte, and Whitetail Cabin, with possibilities, in the long term, of adding Sage Creek Cabin as budgets permit. By 1920 there were at least 14 districts identified on the Gallatin National Forest. At least fifty historic guard and ranger stations, dating from 1905 to 1940, were constructed across the Custer Gallatin and are described in a recent publication (MacLean 2013, pages 68–94). At least 24 of these buildings are in the cabin rental program. Fifty-six historic trails on the Custer Gallatin National Forest have been recorded and are still maintained for administrative and public use.

Restoration of fire lookouts has been conducted at Poker Jim and Tri Point Lookout Tower. These historic sites are still maintained and are seasonally used as lookouts when needed.

The Civilian Conservation Corps built environment and contributions to the Custer Gallatin are still evident and in use. Campgrounds built by the Corps include: Basin, Camp Sheridan, Cascade, Palisades, Parkside, Ratine, Pine Creek and Butte Meadows. Former Civilian Conservation Corps camps—the Needmore Camp and Squaw (Shenango) Creek Camp—are maintained and used today for administrative and recreational purposes. The Whitetail Cabin was built as a ranger station and is now serves as a rental cabin. An impressive arch-deck, concrete bridge spanning the West Gallatin River near Squaw (Shenango) Creek Ranger Station, was built in 1935 by youths stationed at the Squaw (Shenango) Creek Civilian Conservation Corps Camp. Despite its age of over 80 years, this bridge continues to serve administrative and recreational vehicle traffic.

On the Ashland and Sioux Districts most of the main access roads were built by the Civilian Conservation Corps and are still maintained and in use today. They include 10 and 15 Mile Roads, Beaver Creek – Stacey Road, Beaver Creek Liscom Road, and Cow Creek road on the Ashland District; and Ekalaka-Stagville, Dugan, Snow Creek, Plum Creek, and Capital Rock Roads on the Sioux District. These districts are also sprinkled with numerous reservoirs and spring developments attributed to the Corps workforce, addressing the need for rangeland water during the drought stricken, and “dirty thirties.”

These cultural resources reflect the use of all the ecosystems within the Custer Gallatin National Forest, from the pine savanna to the mountains and river corridors and alpine environments for generations. Preservation of historic properties, traditional cultural properties and traditional landscapes are important as a reminder of the collective past and a link to the future.

3.13.3 Environmental Consequences

Effects Common to All Alternatives

Compliance with the National Historic Preservation Act Section 106, and all other applicable Federal laws and regulations, are required for all Forest Service undertakings, regardless of the chosen alternative. The identification, evaluation, nomination, protection, and interpretation of cultural and historic resources would occur under all alternatives. Coordination and consultation with interested parties and affected Tribes would also continue in accordance with Federal laws and regulations. Sites eligible for listing in the National Register of Historic Places would formally nominated to the register. Protection protocols and mitigation measures would be used to preserve resources that are inadvertently discovered. All alternatives thus provide protection for cultural resources consistent with National Historic Preservation Act.

Nearly every undertaking by the Forest Service has the potential to affect heritage resources. Not all effects are necessarily adverse and some effects may be avoided either through project redesign or the implementation of standard protection measures.

The North Cave Hills Archaeological and Traditional Use District would not receive any additional protection through any land allocation.

Current Plans

Management Direction under the Current Plans

The existing forest plans are focused on Section 106 compliance and do not consider a balance between compliance, stewardship, and protection of cultural and historical resources. However, numerous Federal laws and regulations exist for the protection and enhancement of these resources regardless of any forest plan direction.

The Custer Forest Plan included a forest wide standard for cultural resources that requires the Forest Service to consult with Native American traditional religious leaders on any project having the potential to affect Native American cultural sites and practices.

Under the current plans, three locations on the Ashland District are “low development areas;” very similar to the revised plan alternatives backcountry areas. The current plans have about 34,000 acres of recommended wilderness area.

Effects of the Current Plans

Under the current plans, compliance with Federal laws and regulations would continue. While the current plans predate the passage of the Native American Graves Protection and Repatriation Act (NAGPRA) and the 1992 amendment to the National Historic Preservation Act (NHPA), the latter, which calls attention to procedures for the identification of traditional cultural properties, the Forest Service must follow these laws under the current plans.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

Forest wide plan components for all revised plan alternatives envision cultural resources providing a tangible link to the past, and their use and interpretation provide public benefits and appreciation.

Effects Common to the Revised Plan Alternatives

Under the revised plan alternatives, compliance with Federal laws and regulations would continue. All revised plan alternatives contain plan components that explicitly state the desired conditions for cultural and historical resources and provide guidance for achieving these desired conditions. Collectively, these plan components serve to ensure that potential adverse effects from land management and visitor use are avoided or minimized. The forest plan, however, is not an assemblage of individual program plans that have unique plan components for each resource. Other resource components may complement and address the management and protection of the cultural resources such as components for the Nez Perce trail and the administration of historic facilities.

Forest management activities have the potential to affect cultural resources through site disturbance or discovery; increase or decrease in site access; or provide the opportunity and funding for conducting site surveys and recordation. Vegetation treatments may enhance associated plants and wildlife habitats that are integral to many traditional cultural properties and landscapes in the forest.

Tribal access can be affected by policy decisions, administrative actions, and physical impacts on the ground. Specific concerns from resource management activities such as road building or other modifications on the landscape, could affect tribal members accessing valued places (gathering areas or sacred sites) or practicing cultural activities. While these specific concerns are best addressed at the site-specific level during project or activity planning, restricting access to public lands can have both beneficial and adverse effects on traditional cultural activities. Restricting access may be beneficial when it preserves the solitude and quiet necessary for fasting, prayer and other ceremonies. It may have a negative effect when it restricts traditional practitioners’ ability to collect traditionally important plant, animal, mineral, fossil resources, and teepee poles. Under all revised plan alternatives, the main arterial and collector system would remain the same, and this system should provide adequate access to most traditional use areas.

Land allocation decisions such as recommended wilderness and backcountry areas, might impact the reserved rights and interests of Tribes by limiting access to locations used for traditional and ceremonial purposes. Sites of importance to Tribes and many resources of tribal interest are located in remote locations and have been used traditionally for many generations. Designating these areas as recommended wilderness or backcountry areas may limit or impair access to these sites by motorized means but would not deter the ability of Tribes to continue to conduct ceremonies and gather resources in traditional ways.

Conversely, designating areas as recommended wilderness or backcountry areas may afford those locations with significant protections that could prevent inappropriate access and damage to sacred sites while preserving these traditional and cultural landscapes. It may also promote the return to historical range of natural variation that includes wildlife and plant habitats used by traditional cultures.

The amount of land in recommended wilderness or backcountry areas varies by alternative as described for each revised plan alternative.

Effects of Alternative B

Alternative B proposes nine recommended wilderness areas and nine backcountry areas. The third highest acreage of lands within these two land allocations, which would provide protective benefits to cultural resources as a result of use restrictions. Mechanized recreation use would continue to be available on about 20 trail miles in recommended wilderness areas, continuing a method of access, which could potentially make sites more prone to defacement, littering, and illegal collection of artifacts, although continuing potential access for tribal members. In addition, in areas of minimal management, effects to cultural resources can result from neglect, leading to deterioration or potential vandalism. For example, the Windy Pass cabin would no longer be offered as a recreational rental, cutting off rental fees used for cabin maintenance.

The nine backcountry areas include Big Pryors and the Tongue River Breaks. These locations contain traditional cultural properties important to the Tribes and the direction to maintain the generally or lightly developed character of these areas helps to preserve and protect these cultural resources, while continuing existing access.

The Stillwater Complex land allocation encompasses a number of historic mining sites including the Benbow and Mouat mines. These mining sites demonstrate an historic and ongoing mining tradition and the integrity of these sites show the success of consultation with the Stillwater Mine in preserving these important cultural resources.

Under this alternative, there would be eight recreation emphasis areas suitable for high-density recreational development and use. Effects to cultural resources can occur from construction and/or reconstruction of campgrounds and trampling of cultural resources by people and vehicles, from increased vandalism. Most of these recreation emphasis areas are located along rivers and creeks on level locations which were also preferred locations of cultural resources – what people look for in a campsite site now is often the same locations that past occupants used. These water corridors were also used as travel corridors in prehistoric and historic times and evidence of the use of these trails may be compromised by increased and concentrated recreational use. Compliance with cultural resource laws require survey, avoidance or mitigation of potential impacts to cultural resources.

Projected vegetation treatment acres, including timber and fuels, range from 6,000 to 7,500 acres. Harvesting timber can affect cultural resources through ground disturbance caused by felling trees, skidding logs, road construction, slash disposal, and other activities. With potential increased access in support of these activities comes the possibility of increased artifact collection and vandalism of cultural resources. Fuel treatments may also reveal new cultural resource sites previously obscured by vegetation, adding to the site record but also visible to illicit collectors. These projects, however, would be subject to section 106 review and compliance, and cultural resources recorded and mitigated, adding to knowledge of the site record.

Heritage resource inventories in response to projects would be less than alternative D, but more than alternative E, with a commensurate relative potential for presently unknown cultural resources to be lost, damaged or exposed from naturally occurring erosion and wildfire, and less opportunity to contribute to the site record and understanding of the cultural resources in these areas.

Treatments for hazardous fuel reduction has a long range benefit to certain types of cultural resources by making these sites more fire resistant and less subject to wildfire suppression actions such as dozer line construction. Increased site recordation from these actions also identifies cultural resources at risk and those requiring additional site protection.

Effects of Alternative C

Alternative C proposes a mix of land allocations similar to alternative B with the addition of backcountry areas in the Crazy Mountains traditional cultural property and landscape, and restrictions on existing motorized and mechanized recreation use in recommended wilderness areas and the Pryor Mountains backcountry areas. Alternative C proposes the second highest acreage of lands within the recommended wilderness area and backcountry area land allocations.

Effects are similar to alternative B for recreation emphasis areas, ground disturbance from projected vegetation acres, and the Stillwater Complex allocation. Under alternative C, motorized and mechanized recreation use would no longer be available on about 3.6 miles of trail, and mechanized recreation use would no longer be available on about 20 miles of trail.

The addition of a backcountry area in the Crazy Mountains would help to preserve and protect the traditional cultural property and landscape found there as well as those found in the Big Pryors and the Tongue River Breaks, although restricting motorized and mechanized recreation use in the Pryor Mountains backcountry areas may restrict some methods of access for tribal members.

Non-wilderness uses would be prohibited in the recommended wilderness areas as they are in alternative B with the exception that provides for the continued use of the Windy Pass cabin. The continued rental use would ensure continued funding for cabin protection and preservation.

Effects of Alternative D

Alternative D proposes the highest acreage of lands within the recommended wilderness area and backcountry area land allocations, and highest number of acres for vegetation treatment.

With 39 recommended wilderness areas in alternative D, the traditional cultural properties and landscapes, cultural resources located within the Pryor Mountains, Crazy Mountains, and Tongue River would receive the greatest level of preservation and protection, although certain means of access to these areas may be restricted for Tribal members. The Windy Pass cabin would no longer be offered as a recreational rental, cutting off rental fees used for cabin maintenance.

The backcountry area for the Chalk Buttes would help protect this traditional cultural landscape that has at least one traditional cultural property.

The Boulder River and Hebgen Lakeshore locations have a documented high density of cultural resources including a number of aboriginal trails.

Four recreation emphasis areas are proposed, and do not include the Boulder River and Hebgen Lakeshore locations which have a documented high density of cultural resources including a number of aboriginal trails. Excluding these locations may lessen the direct and indirect effects to these areas from concentrated and increased visitor use. The effects to the four recreation emphasis areas remain the same described in alternative B.

About 8,000 acres are projected for vegetation treatment acres, including timber and fuels. The effects of projected vegetation treatment acres are the same as Alternatives B and C, but over a larger area.

Effects of Alternative E

Alternative E emphasizes a higher human presence and use of the Custer Gallatin. This alternative proposes higher motorized recreation opportunities than other alternatives. There would be no recommended wilderness areas and two backcountry areas. Alternative E proposes the fourth highest acreage of lands within the recommended wilderness area and backcountry area land allocations. Cultural resources would be more accessible and more prone to defacement, littering, and illegal collection of artifacts than other revised plan alternatives, but less accessible than in the current plans. The Windy Pass cabin would still be offered as a recreational rental, and rental fees used for cabin maintenance.

Traditional cultural properties and landscapes located in the Pryor Mountains, Tongue River Breaks, Chalk Buttes, and the Crazy Mountains would have no additional land allocations, although plan components in all revised plan alternatives recognize traditional use of springs in the Chalk Buttes.

Under this alternative, there would be eleven recreation emphasis areas suitable for high density recreational development and use. Effects associated with recreation emphasis areas are the same as alternative B, over a larger area. The Stillwater Complex allocation is proposed, with the effects similar to alternative B.

About 5,000 acres are projected for vegetation treatment acres, including timber and fuels. Fewer acres of vegetation and fuel treatments would reduce potential impacts from these activities compared to other alternatives.

Since the need for heritage resource inventories in response to projects would decrease, there would be less opportunity to contribute to the site record and understanding of the cultural resources in these areas.

Consequences to Cultural and Historic Resources from forest plan components associated with other resource programs or management activities

Effects from Fire and Fuels Management

Fire suppression techniques such as fire line construction could impact cultural resources. However, under all alternatives, minimum impact suppression tactics (MIST) would be used to prevent damage to culturally sensitive areas. Surveys are completed before implementation of mechanical fuels treatments and prescribed fires to ensure that there are no impacts to cultural sites. Prescribed burning and wildfire, under the right conditions, may increase the propagation of certain tree and grass species that have traditional use. Wildland fire may also uncover previously unknown sites by clearing ground fuels.

Effects from Access, Recreation and Infrastructure

Recreation can potentially affect cultural, historical, and tribal resources through its effects on both ground disturbance and visitor use. Ground disturbance may occur through the construction and management of recreation sites, or use of motor vehicles for recreation. While the development and maintenance of infrastructure such as roads and trails has the potential to affect cultural and historical resources through ground disturbance, both plan components and legal direction ensure that any potential effects are considered and mitigated in all alternatives. Roads, trails, camping areas, and other infrastructure would be designed in such a way as to minimize any negative impacts associated with their construction and use. Revised plan alternative direction associated with visitor education can also help to minimize impacts from visitor use.

Motorized vehicle use can be particularly harmful due to the potential for increases in both ground disturbance and ease of access. Unauthorized, user-created routes and areas can negatively affect historical and cultural resources. Effects of motorized use include physical damage resulting in or from erosion, downcutting, rutting, or displacement of cultural features, and potential vandalism and looting, and can occur outside of designated routes and areas, such as at adjacent dispersed camping areas. Because adverse effects on cultural resources have been observed where motorized users have gone off road, the revised plan alternatives provide objectives to close and rehabilitate unauthorized recreation routes in non-motorized recreation settings in an effort to minimize future damage.

Recreation plan components emphasize providing opportunities for visitors to connect with and learn about both the natural and cultural environment. These opportunities could help to instill a sense of stewardship in forest visitors, potentially minimizing impacts to cultural and historical sites through careless use or direct vandalism. The current plans, alternatives B, and C propose more public outreach projects than alternatives D and E, and would further enhance the interpretation and stewardship of the historic resources.

The Custer Gallatin National Forest manages a portion of the Nez Perce Trail, which has significant cultural and historical value. Plan components associated with management of the trail ensures that they conserve important cultural and historical resources while allowing visitors an opportunity to learn about the local and Tribal history.

Effects of Wild and Scenic Rivers Land Allocation

Several of the river segments that are identified as eligible to become wild and scenic rivers are eligible at least in part due to their outstanding cultural value. Eligible wild and scenic rivers must be managed to maintain the outstanding remarkable values for which they have been identified, which could result in greater protection for the outstanding cultural or historical values in these river segments. Plan direction further specifies that any recreation facilities "must be located and designed to harmonize with the natural and cultural settings." This would ensure that any development would not detract from the cultural value.

Recreational use does have the potential to affect cultural and historic resources near eligible rivers, but the recreation plan components described above would also apply near eligible wild and scenic rivers and would serve to avoid or mitigate any adverse effects associated with visitor use.

Effects from Energy and Minerals Management

Mineral activities such as mining and oil and gas exploration can have adverse effects on cultural resources and traditional cultural properties and landscapes, but legal requirements apply in all alternatives and revised plan alternatives include plan components designed to avoid or mitigate these effects. The Custer Gallatin would consult with Tribes when mineral management activities may impact treaty rights, cultural sites, or traditional uses in all alternatives. The revised plan alternatives place a greater emphasis on ongoing communication and collaboration with tribal stakeholders compared to the current plans.

Cumulative Effects

Cumulative effects, over time, can include loss and damage to cultural resources and the effects past activities. Management practices are reflected in the condition of the historical landscapes and cultural resources that remain today. With the preservation laws, regulation, and policies in all alternatives and revised plan alternative plan components designed to preserve and enhance the cultural resources, traditional cultural properties, and historic landscapes, the cumulative effects from all alternatives would allow the continued protection and preservation of the Custer Gallatin's cultural resources.

Much of the lands near and adjacent to the Custer Gallatin are managed by Federal land management agencies; other national forests, national parks, and Bureau of Land Management lands. All Federal agencies have requirements for Government-to-Government meetings with affected Tribes to consult and coordinate management of the land and cultural resources to meet tribal and agency responsibilities under the National Historic Preservation Act. Land and resource management under the forest plan is generally complementary with management across the Federal agencies regarding historic properties, traditional cultural properties, and landscapes.

Conclusion

Management actions that result in ground disturbance have the potential for effects to cultural resources and traditional cultural properties. The number of acres subject to vegetation management activities is greatest in alternative D, followed by the current plans, alternatives B, and C (which treat a similar amount), and finally alternative E.

Visitor use has the potential to harm cultural and historical resources, and so differences in access can affect the potential for harm and associated mitigation measures. Alternative D places the greatest restrictions on new roads and existing mechanized and motorized recreation use, followed by alternatives C, B, E and then the current plans. All revised plan alternatives contain components designed to minimize this risk using education and strategic placement of recreation infrastructure to protect sensitive cultural resources.

All revised plan alternatives include components designed to avoid or minimize any adverse effects of any management activity. Furthermore, potential effects are identified, detailed, and disclosed during site-specific analysis, which gives the Forest Service the opportunity to determine appropriate mitigation, avoidance, and protection measures. Thus, the consequences to cultural resources from actions associated with other programs are estimated to be minimal or avoidable under all alternatives.

3.14 Permitted Livestock Grazing

3.14.1 Introduction

Livestock grazing has been, and continues to be, an important multiple use of National Forest System lands within the Custer Gallatin National Forest. Livestock grazing has been a use of public lands since the inception of the Forest Service and has become an important part of the culture of the rural western U.S. The policies for Forest Service management of rangelands include managing rangeland vegetation to provide ecosystem diversity and environmental quality while maintaining relationships with allotment permittees; meeting the public’s needs for rangeland uses; providing for livestock forage; maintaining wildlife food and habitat; and providing opportunities for economic diversity. Rangeland management is an essential part of the Forest Service multiple-use concepts.

Although rangelands provide a variety of ecosystem services, such as wildlife habitat, recreation, watershed functions, carbon sequestration, and biodiversity conservation, these lands have primarily been managed for forage production and livestock grazing. Forage is managed by the Forest Service to be sustainable, ensuring that it will be available for future generations while still providing the other rangeland’s ecosystem services required by their multiple use strategy. To accomplish this, the Forest Service divides rangelands into allotments and monitors each one. Additionally, the Forest Service manages forage in transitory range. Transitory range is defined as forested lands that are suitable for grazing for a limited time following a timber harvest, fire, or other landscape event.

Grazing permits for each allotment are issued to eligible commercial livestock owners. Livestock grazing management is established through forest plans, Forest Service grazing guidelines, and individual allotment management plans. These plans are developed to be comprehensive, using sound science and incorporating public involvement. Plans are revised and updated to ensure that livestock grazing management decisions are based on existing and future ecological, social, cultural, and economic conditions.

The successful management of livestock grazing use on the Custer Gallatin National Forest relies upon the maintenance of healthy, functioning rangelands. Refer to the discussions for grasslands, shrublands, woodlands, riparian areas and wetlands, and sparsely vegetated communities in the terrestrial vegetation section and the Riparian Management Zone portion of the watershed, aquatics, and riparian sections. These sections focus on the health of those plant communities utilized for grazing purposes, and how revised forest plan components would affect the plant communities upon which livestock grazing depends.

Regulatory Framework

36 CFR 222, subparts A and C provides the authority to administer the grazing and livestock use permit system

36 CFR 219.10 requires that the forest plan under the 2012 Planning Rule must include plan components for integrated resource management to provide for ecosystem services and multiple uses including forage for grazing.

Organic Administration Act of 1897: Provides the main statutory basis for the management of forest reserves. States that the intention of the forest reserves (which were later called national forests) was to “improve and protect the forest” and to secure “favorable conditions of water flows” and provide a “continuous supply of timber for the use and necessities of citizens of the United States.” This act also authorizes the Secretary of Agriculture to designate experimental forests and ranges, and to set forth broad direction for establishing and administering these areas.

Multiple Use-Sustained Yield Act of June 12, 1960 (P.L. 86-517, 74 Stat. 215, 16 U.S.C. 528-531). Established the policy and purpose of the National Forests to provide for multiple-use and sustained yield of products and services.

Secure Rural Schools and Community Self-Determination Act of October 30, 2000 (P. L. 106-393, 114 Stat. 1607; 16 U.S.C.500 note): This act provides provisions to make additional investments in, and create additional employment opportunities through, projects that improve the maintenance of existing infrastructure, implement stewardship objectives that enhance forest ecosystems, and restore and improve land health and water quality. This act was designed to stabilize annual payments to state and counties containing National Forest System lands and public domain lands managed by the Bureau of Land Management. Funds distributed under the provisions of this act are for the benefit of public schools, roads, and related purposes.

Wilderness Act (1964) (16 U.S.C. 1131-1136): This act provides the statutory definition of wilderness and management requirements for these congressionally designated areas. This act established a National Wilderness Preservation System to be administered in such a manner as to leave these areas unimpaired for future use and enjoyment as wilderness.

The Public Rangelands Improvement Act of 1978 recognizes the need to correct unsatisfactory conditions on public rangelands by increasing funding for maintenance and management of these lands.

The Rescission Act of 1995 directs the FS to complete site-specific environmental analyses and decisions for grazing allotments on a regularly scheduled basis based on the permit requirements.

Forest Service Manual 2200 provides direction for rangeland administration on National Forest System lands.

Forest Service Handbook 2209.13 provides direction for permit administration on National Forest System lands.

USDA Environmental Compliance, Policy on Range, Departmental Regulation, Number 9500-5, April 21, 1988; This regulation sets forth Departmental Policy relating to range services and coordination of range activities among agencies of the USDA and other executive agencies, organizations, and individuals.

Key Indicators and Measures

The indicators and measures used to analyze effects or changes to livestock grazing opportunities on the Custer Gallatin National Forest are:

- Expected trend in moving towards desired rangeland condition as a result of management actions based on the implementation of plan components, such as more intensive management of riparian areas and riparian management zones.
- Expected changes in potential added difficulty for livestock management due to land allocations.

Methodology and Analysis Process

Methods includes both quantitative and qualitative analysis. Animal unit month (AUM)[15] objectives were based on currently permitted AUMs on active allotments from the Natural Resource Management database and project file information on vacant allotments.[16]

[15] An animal unit month or AUM is the amount of oven-dry forage (forage demand) required by one animal unit for a standardized period of 30 animal-unit-days. This would be 780 pounds dry weight forage for a 1,000-pound cow for one month (using 26 pounds/day/cow). AUM is not synonymous with animal month or head month. A head month (HM) is defined as one month's use and occupancy of the range by one animal. For grazing fee purposes, it is a month's use and occupancy of range by one weaned or adult cow (with or without calf), bull, yearling steer or heifer, horse, mule or other applicable permitted animal.

[16] AUM objectives for alternatives D and E (213,802) were based on currently permitted AUMs from Natural Resource Management database for Term, Term on/off - On Provision, Term Private Land, and Temporary Grazing (issued for livestock use permits) permit types where permit status is active, line status is active or modified, line type it permitted use, and count flag is yes. AUM objectives for Alternatives A, B and C (219,306) were based on the same AUMs as Alternatives D and E (213,802) plus the AUMs previously permitted on vacant allotments (5504 - project file).

The following assumptions are used to determine the degree of impacts on livestock grazing. These assumptions are based on previous assessments, professional judgment, and Forest Service rangeland management and planning directives.

- Livestock that use rangelands can remove plant material, trample soils, and alter water flow patterns. However, with proper management these impacts are not substantial when compared with the natural resilience of ecosystems (Holling 1973).
- Livestock grazing would be managed to meet specific standards and guidelines for rangeland health and resiliency, including riparian standards and guidelines. In addition, range improvements would be used to meet standards and guidelines for rangeland health and achieve rangeland management goals.
- The grazing prescription in each allotment would remain the same as it is currently, and permitted AUMs for each active allotment is not expected to increase or decrease unless changed through a site-specific analysis or allotment management plan update. However, a permit modification to all permits would incorporate the end of season 4- to 6-inch stubble height guideline in low gradient riparian greenline areas under all revised plan alternatives.
- Impacts on livestock grazing would be the result of activities that affect forage levels or the potential for limiting of motorized access to allotments.
- Mitigations for impacts to, or from, livestock would be addressed in a site-specific analysis for allotments.
- Grazing use would be managed similarly in all alternatives.
- Grazing allotments would remain open as long as there continues to be demand, existing permits remain in good standing, and resource conditions are meeting or moving towards desired conditions.

Information Sources

The science of assessing rangelands is evolving as certain concepts and ecological processes are becoming better understood. General concepts for maintaining or moving towards desired rangeland condition focus on aspects of ground cover, species composition and the presence or absence of invasive species as indicators.

Information sources include current scientific literature, Forest Service reports and databases, and other documentation. Data used to analyze the existing condition for livestock grazing and the rangeland resource came from the following sources:

- Forest Service Natural Resource Manager database (includes grazing allotment, permitted use and range improvement data).
- Completed range analyses (includes range vegetation inventory and assessment data).

Analysis Area

The geographic scope of the analysis is the lands administered by the Custer Gallatin National Forest and other lands that are jointly used in allotment grazing systems. All lands within the Custer Gallatin National Forest boundary and other lands that are jointly used in allotment grazing systems form the geographic scope for cumulative effects, and the temporal scope is the anticipated life of the plan.

3.14.2 Affected Environment (Existing Condition)

Allotments and Permittees

At present, 199 permittees are grazing livestock on 215 active grazing allotments. In addition, the Custer Gallatin National Forest has 18 vacant allotments. Approximately one-third (36 percent) of the Custer Gallatin National Forest consists of livestock grazing allotments (22 percent of the montane units and 93 percent of the pine savanna units). However, approximately one-fifth or 22 percent of the Custer Gallatin National Forest consists of primary rangeland where livestock generally graze (6 percent of the montane units and 86 percent of the pine savanna units).

Rangeland Capability and Suitability

Capable rangelands produce forage or have inherent forage producing capabilities, and if accessible can be grazed on a sustained yield basis. Primary rangelands are those areas that produce forage and that are near water where primary grazing activity occurs. On Custer Gallatin National Forest rangelands, livestock tend to congregate on the more convenient gentle terrain such as valley bottoms, riparian, hardwood draws, and ridgetops. Secondary rangelands are those areas that produce forage but are too far away from water or access is impeded due to natural barriers. Transitory rangelands are areas near water and accessible to livestock where forage was temporarily created by changed vegetative conditions from events such as wildfire or activities such as timber harvest.

About 658,000 acres (National Forest System lands within allotments) or 22 percent of the Custer Gallatin National Forest lands are considered primary rangeland. 86 percent of the pine savanna ecosystems (Ashland and Sioux geographic areas) are considered primary rangeland. Across the montane ecosystems that make up the rest of the forest, just 6 percent of the land is considered primary rangeland. About 38,100 acres or about 1 percent of the Custer Gallatin National Forest is considered secondary rangeland.

Suitable areas are capable areas minus areas chosen to be unacceptable to graze to minimize conflicts with areas such as developed recreation sites, research natural areas, fenced rights-of-way or other areas closed by decision. These suitable areas must also be accessible to a specific kind of animal and can be grazed on a sustained yield basis. The existing forest plans are supported by a grazing suitability analysis that was done in the mid-1980s. In addition, there have been various suitability analyses conducted on allotments that have been closed since then. Allotment specific capability and suitability analyses have been conducted on allotments with changed conditions resulting in decisions that have refined capability and suitability aspects relative to livestock use. Current allotments are deemed suitable for permitted grazing and suitability is verified during allotment level National Environmental Policy Act analyses.

Allotment Management Plans

Allotment management plans contain the pertinent livestock management direction from the project-level National Environmental Policy Act-based decisions and include a general monitoring plan. These decisions and allotment management plans are considered part of the permit's terms and conditions.

Annual operating instructions document actions that are needed for implementation of the management direction set forth in the project-level decision. The annual operating instructions identify the obligations of the permittee and the Forest Service and articulates annual grazing management requirements, standards, and monitoring necessary to document compliance. Annual operating instructions are typically issued to allotment permittees during annual meetings prior to the grazing season.

Many allotments are inspected annually. Compliance problems with the terms and conditions of grazing permits vary across the units and follow-up actions are initiated. Compliance with permit terms and conditions relates to whether a permit holder ensures that annual instructions or allotment management plans are being followed, including timing, intensity, and location of stock. It also includes such items as maintenance of range improvements per permit terms and conditions. Generally, range inspections with permittees are done on those allotments where compliance issues have developed in order to try and jointly resolve the issues where possible.

Allotment management integrity relies heavily upon the maintenance of the related infrastructure such as fences, reservoirs, pipelines, and water troughs that have been established throughout the Forest. Allotment infrastructure is most prevalent on the Sioux and Ashland Districts. There are approximately 2,800 miles of fence and about 1,850 water developments related to the management of allotments.

Some level of allotment management planning has been completed on nearly all of the 234 active and vacant allotments on the Custer Gallatin National Forest. About 91 percent or 212 allotments (active and vacant) have had National Environmental Policy Act environmental analysis. Currently, the 22 allotments (15 active and 7 vacant) that have not had environmental analysis conducted have been scheduled for revision over the next 10 years. Other allotments may also have priority needs for assessment as well.

Permitted Livestock and Grazing Use

Permitted livestock grazing is widespread across the Custer Gallatin National Forest. There are approximately 36,200 head of cattle, 550 horses and 400 domestic bison permitted to graze at various times throughout the year on National Forest System lands and associated private lands. In general, for the pine savanna units the primary grazing season is between May 20 and November 15 and from June 15 to October 15 for the montane units, although some are longer or shorter. About 57 percent of the permittees are permitted to graze lands within the pine savanna units and 43 percent in the montane Units.

There are 205,064 animal unit months (AUMs) permitted on National Forest System lands and about 8,738 animal unit months permitted on associated intermingled private lands.[17] The pine savanna units provide 81 percent of the total permitted animal unit months. The Ashland Ranger District provides 61 percent of the total permitted animal unit months; see figure 50.

[17] Term Private Land Permits are issued when the landowner waives the grazing management of their lands to the Forest Service when the private lands are incorporated into allotments when it makes a logical grazing unit.

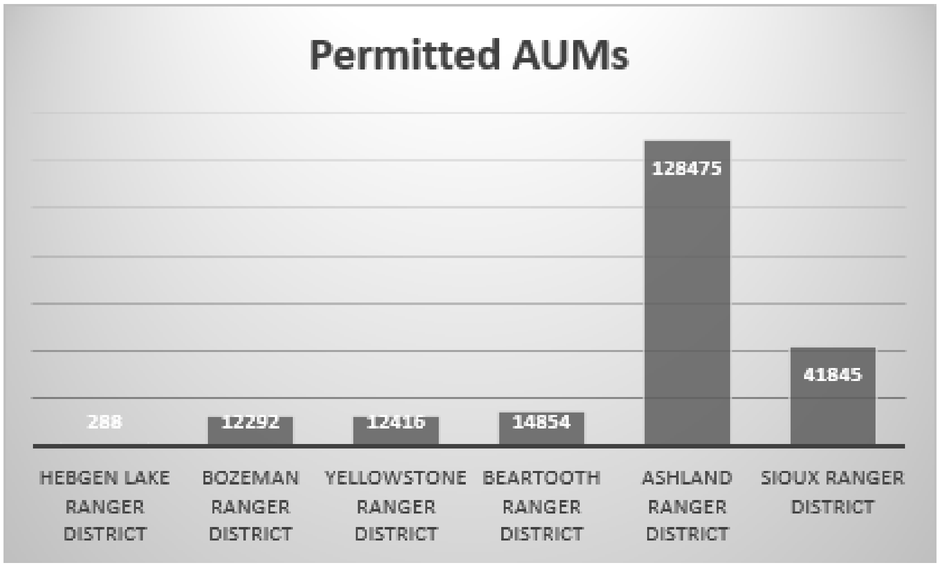

Figure 50. Permitted animal unit months by ranger district

Table 72 displays allotments in vacant status and their estimated capacity in animal unit months.

Table 72. Vacant allotments, estimated capacity in animal unit months (AUMs)

Allotments in Vacant Status	Geographic Area	AUMs
Cottonwood (Gardiner RD)	Absaroka-Beartooth Mountains	218
Lion Creek (Gardiner RD)	Absaroka-Beartooth Mountains	537
Mill Creek (Gardiner RD)	Absaroka-Beartooth Mountains	212
Section 22 (Gardiner RD)	Absaroka-Beartooth Mountains	232
Contact (Yellowstone RD)	Absaroka-Beartooth Mountains	113
Evergreen (Yellowstone RD)	Absaroka-Beartooth Mountains	159
Green Mountain (Yellowstone RD)	Absaroka-Beartooth Mountains	633
Grouse Creek (Yellowstone RD)	Absaroka-Beartooth Mountains	688
Lost Cabin Creek (Yellowstone RD)	Absaroka-Beartooth Mountains	403
Nurses Lake (Yellowstone RD)	Absaroka-Beartooth Mountains	498
Main Boulder (Yellowstone RD)	Absaroka-Beartooth Mountains	120
Deep Creek South (Yellowstone RD)	Absaroka-Beartooth Mountains	200
Mill Creek (Yellowstone RD)	Absaroka-Beartooth Mountains	146
Suce Creek (Yellowstone RD)	Absaroka-Beartooth Mountains	177
Sixmile South (Yellowstone RD)	Absaroka-Beartooth Mountains	230
West Bridger Forage Reserve (Bozeman RD)	Bridger, Bangtail, Crazy Mountains	179
Sheep Mile Forage Reserve (Hebgen Lake RD)	Madison, Henrys Lake, Gallatin Mountains	571
Red Butte (Beartooth RD)	Pryor Mountains	188
Total	(Not applicable)	5,504

Recent decisions determined that Sheep Mile and West Bridger were good candidates as forage reserves to provide for management flexibility as grass banks generally for existing permittees in situations such as drought, wildland fire, other management needs, or emergency situations. A recent decision for Red Butte Allotment determined that it would be offered to an existing permittee as an option to move from their current allotment or face a reduction of permitted animal unit months in their current allotment. Yellowstone Ranger District's Suce Creek and Mill Creek Allotments are currently being considered as part of the East Paradise Allotment environmental analysis, being reviewed as potential forage reserves or for re-activation as opportunities arise. A very small portion of Sixmile South Allotment (Stands Basin) has been considered to potentially being an option to include in the Slip and Slide Allotment when that allotment undergoes environmental review. It would be to improve conditions by reducing duration within pastures without increasing overall animal unit months. The remaining vacant allotments do not have recent decisions or are not involved in a current environmental analysis.

Authorized Use

Permitted use typically reflects years of management, observations, and monitoring of initial stocking rates. However, annually, specific authorized use for an upcoming season may be a change from the permitted use to accommodate any need to respond to resource concerns (for example, drought or fire) or permittee convenience. It is estimated that authorized use has ranged from 65 percent to 100 percent of what is permitted. Figure 51 through Figure 53 display authorized use levels since 1999. The dips in authorized use strongly correspond to responses to drought periods and large wildfire events.

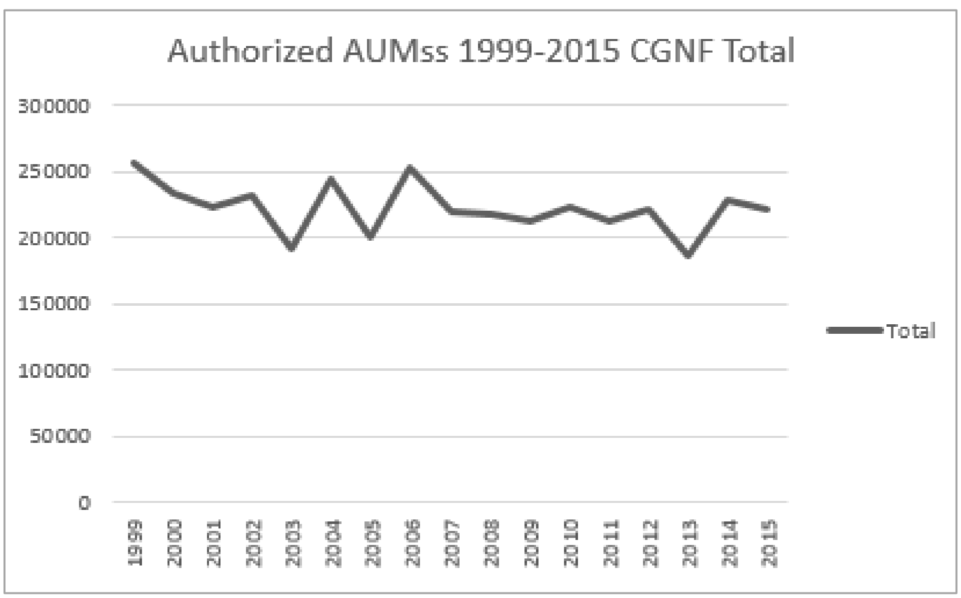

Figure 51. Authorized animal unit months for term permits from 1999 through 2015 - Custer Gallatin National Forest

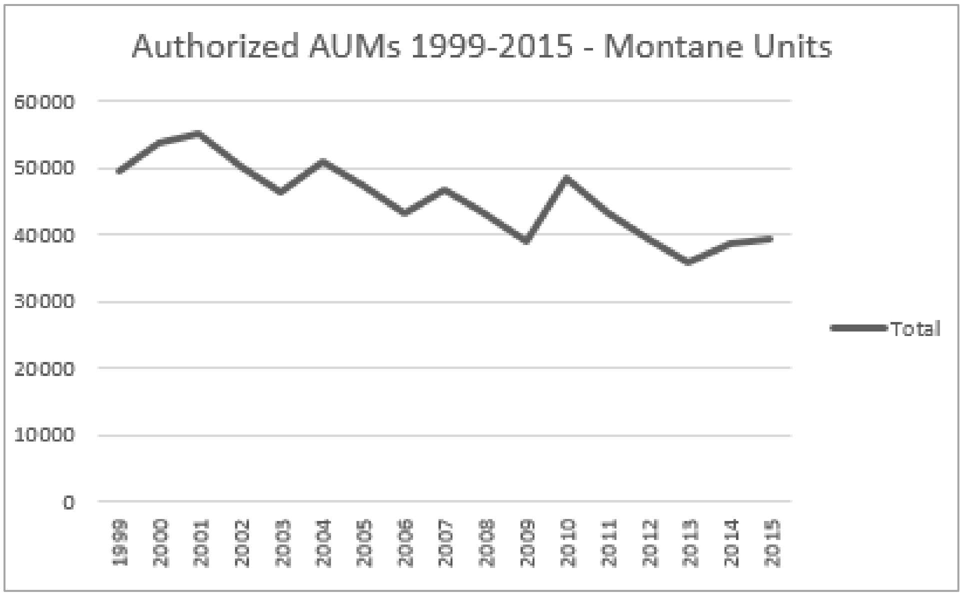

Figure 52. Authorized animal unit months for term permits from 1999 through 2015 – montane ecosystems

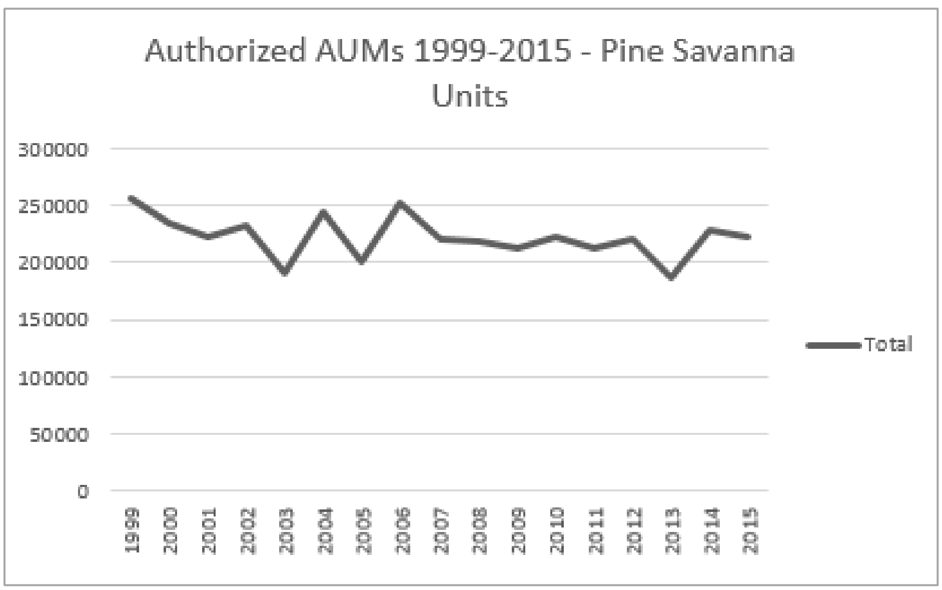

Figure 53. Authorized animal unit months for term permits from 1999 through 2015 – pine savanna ecosystems

Actual Use

The actual livestock numbers and season of use have varied greatly through time. Actual use numbers often vary from year to year and are reflective of variations in precipitation, changes for permittee convenience (late turn-outs or early removals, yearly differences in numbers of stock), and actions initiated for resource protection such as allowable utilization levels being met. Records of actual use data have been kept through history. Actual use information is used to properly assess existing management and use levels that have led to existing vegetation conditions. Actual use level is generally near the authorized use level unless events such as wildfire occur. On some districts, actual use numbers are generally close to authorized numbers, but in some cases actual use length of season have been shorter than that authorized due to fall shipping, pine needle poisoning, or fall hunting considerations.

Stocking Rates

Livestock must be managed properly to insure the long-term sustainability of the resource base. Proper grazing management depends in part on determining correct livestock numbers per area of land, known as the stocking rate. Stocking rate is often expressed as acres per animal unit month. Proper stocking rates are site specific and can be variable. Key factors influencing proper stocking on any given parcel of land include, but are not limited to, permittee management knowledge and effectiveness, topography, water availability, plant communities and their distribution, aspect, slope, forage palatability, current year's precipitation and seasonal distribution, fire (both wild and prescribed), drought, wildlife effects, recreational activities, and livestock age and size. With larger animals, as in many of today's cattle weights, and presumably a corresponding greater consumption rate, the allowable use level might be met sooner and the livestock moved off a pasture sooner than would occur with smaller animals. Stocking rate adjustments can be and have been made through permit modifications where sufficient information indicates that a change is needed to move towards desired conditions.

Rangeland Condition and Trend

Noxious weeds, bare ground and species composition were attributes tested in a Forest Service Intermountain Region Study (O'Brien et al. 2003) and proved to be viable indicators of rangeland health and functionality at a broad scale.

Presence and amount of noxious weeds is a key indicator for overall rangeland heath because of their aggressive capability of outcompeting native species. Noxious weeds are present on most allotments in low densities, most notably along roadways and in past wildfire areas. A low amount of infestations (about 6 percent) and density of noxious weeds occur within primary rangelands on the Custer Gallatin National Forest indicating overall minimally impactive conditions for this attribute.

Presence and amount of bare ground is a key indicator for overall rangeland health. Ground cover (basal vegetation, wood, rock, moss/lichen/crusts, and litter) aids in soil stability and minimizes water and wind erosion. Bare ground does not aid in soil stability. Noble (1963) indicated that for a wide variety of soil conditions and vegetal types in the Intermountain West, a minimum of 60 to 70 percent ground cover is needed to effectively control surface runoff of water and erosion occasioned by torrential summer rainstorms. The same study also indicated that when groundcover has been reduced below these amounts, overland flow and soil losses increased at an extremely rapid rate. This ground cover threshold is consisted with findings from other studies (Gary 1975, Singer and Blackard 1978, Benavides-Solorio 2005, Robichaud et al. 2010). Consistent with this research, on the Gallatin elk winter range in Montana, ground cover of at least 70 percent was considered necessary for restoring and maintaining soil stability (Packer 1963). Basic ground cover and bare ground data were captured for 3,788 visual macroplots during various vegetation inventories on the Custer Gallatin National Forest (in both forested and non-forested types; Natural Resource Manager corporate database). A 70 percent ground cover figure equates to 30 percent bare ground. Ninety-five percent of the overall plots had 30 percent or less bare ground with 81 percent being at 10 percent or less bare ground indicating satisfactory overall conditions for this attribute.

Species composition is a key indicator for overall rangeland health. At the time of the 1986 and 1987 forest plans, the Gallatin portion of the Custer Gallatin National Forest was estimated to have about 77 percent of suitable rangelands considered to be in good to excellent condition, while 23 percent was considered to be in fair condition (1987 Gallatin Forest Plan) primarily based upon species composition. The Custer portion of the Custer Gallatin National Forest was estimated to have about 66 percent of suitable rangelands considered to be in good to excellent condition, while 32 percent was considered to be in fair condition and two percent in poor condition primarily based upon species composition (1986 Custer Forest Plan). Rangeland analysis conducted since this timeframe cannot be aggregated up to a forestwide scale as most analysis were site specific depending upon identified issues. However, many improvements, administrative reductions, and environmental analysis decisions on 91 percent of the Custer Gallatin National Forest allotments that have been made since then have inherently improved composition conditions indicating satisfactory overall conditions for this attribute as follows.

Uplands

Past management practices have altered the composition and structure of plant communities and are affecting the ecological integrity in some portions of the uplands. Based on field observations and comparisons to data collected in the 1960s, there has been an upward shift towards more mid-structured grass species. However, there is still a need to continue to increase the amount of mid-structured grass species on all allotments with less dominance of short-structured grass species so that they exhibit closer similarity to potential in these areas. Some conifer colonization into meadows, shrublands, grasslands, and interspaces has occurred largely due to fire suppression over time.

Riparian Areas and Wetlands

Riparian areas and wetlands occur on less than 3 percent of the Custer Gallatin National Forest. As rare and biologically important landscape components, riparian areas and wetlands are targeted to be managed to be maintained or moved toward their potential hydrological and vegetative attributes. Within the primary rangelands permitted for grazing in the Custer Gallatin National Forest, 71 percent of the survey sites were in proper functioning condition (Prichard et al. 1998, Prichard 2003), with 27 percent functioning at-risk and 2 percent rated as nonfunctional. Within the montane units, 72 percent of the survey sites were in proper functioning condition, with 25 percent functioning at-risk and 3 percent rated as nonfunctional. Within the pine savanna units, 58 percent of the survey sites were in proper functioning condition, with 42 percent functioning at-risk and none rated as nonfunctional. Recent management decisions for addressing nonfunctional sites have been through minor fencing or other applicable mitigation relative to grazing impacts. Recent management decisions for addressing the at-risk sites have been through a mix of grazing prescription changes such as reduced stocking rate, improved distribution techniques such as proper salting and off-site water development, along with reduced grazing duration and timing considerations. The at-risk and nonfunctional sites are largely a function of legacy issues, including roads, uncharacteristic wildland fire, developed recreation, dispersed recreation, historically unmanaged grazing by livestock, water development, or water diversion. However, this does not discount that there continues to be a need for improved grazing practices and monitoring in riparian areas along streams and in wetlands.

Woody Draws

Woody draws occur on less than 3 percent of the Ashland and Sioux Districts. As a rare and biologically important landscape component, woody draws to be managed to maintain or perpetuate a network of multi-layer and multi-age class herbaceous plants, shrubs, and trees. Predominant species included in the draws are green ash, box elder, hawthorn, wild plum, chokecherry, and snowberry. Sites that have lost the capability of improvement (without extremely high investment and energy) generally occurs where sod, often Kentucky bluegrass, impedes seedling establishment (non-functional sites). Most woody draws are intermediate in composition between these two extremes.

Measurements gathered from woody draw health surveys were used to generate estimates of conditions. On the Sioux District, 137 sites (acres not determined) were inventoried of which 21 percent were found to be functioning, 63 percent were at-risk, and 22 percent were nonfunctional. On the Ashland District, of the 299 acres inventoried, approximately 16 percent were considered healthy, 59 percent considered at-risk, and 25 percent considered nonfunctional. Legacy issues such as unmanaged grazing during the turn of the 20th century have contributed to current conditions.

Other

In some isolated site-specific areas, thresholds have been crossed where one or more ecological processes responsible for maintaining a vegetative state have degraded beyond the point of self-repair. Once a threshold has been crossed, the degree of investment and action required to reverse the transition is typically significant. Examples include areas where:

- wildland fire combined with green ash woodlands understory vegetation were altered by turn-of-the-20th-century unmanaged grazing. This past activity promoted higher density sod resulting in lower likelihood of green ash establishment from seed,
- mesic foothills altered by turn of the 20th century unmanaged grazing were adjacent to private land infested with non-native timothy grass and,
- past seeded areas that are still dominated by non-native species such as smooth brome.

Trend

Since the mid-1990s, about 91 percent of all of the allotments (212 active and vacant allotments) have undergone interdisciplinary review and analysis per the National Environmental Policy Act and 1995 Rescissions Act, incorporating forest plan direction. Various rangeland condition data have been collected for these allotment-specific analyses across the Custer Gallatin National Forest by interdisciplinary teams. Decisions were made following environmental analysis to implement identified mitigations needed to improve area conditions that were at issue. The following tables display allotment decision dates by ranger district.

Table 73. Active and vacant allotment decision dates (sorted oldest to newest) for Sioux Ranger District

Allotment Status	Allotment Name	Most Recent Decision Date
Active	Burditt	3/8/1996
Active	Bye-Mrizek	3/8/1996
Active	Capitol Rock/Chiesman	3/8/1996
Active	Castles	3/8/1996
Active	Catron-Pendleton	3/8/1996
Active	Cleveland	3/8/1996
Active	Cox	3/8/1996
Active	Fuller	3/8/1996
Active	Gundlach	3/8/1996
Active	Haivala	3/8/1996
Active	J-B	3/8/1996
Active	Kerr-Whitney	3/8/1996
Active	Kortum	3/8/1996
Active	Moody	3/8/1996
Active	Needmore	3/8/1996
Active	North Ashcroft	3/8/1996
Active	North Range	3/8/1996
Active	North Willard	3/8/1996
Active	Painter	3/8/1996
Active	Park	3/8/1996
Active	Road Draw	3/8/1996
Active	Sawmill Gulch	3/8/1996
Active	South Snow Creek	3/8/1996
Active	South Willard	3/8/1996
Active	Stagville	3/8/1996
Active	Summers	3/8/1996
Active	Wood Gulch	3/8/1996
Active	Box Springs	4/22/2004
Active	Davis Draw	4/22/2004
Active	Dunn	4/22/2004
Active	J A Clarkson	4/22/2004
Active	J B Clarkson	4/22/2004
Active	Jenkins	4/22/2004
Active	John Brown	4/22/2004
Active	Lone Mountain	4/22/2004
Active	Pelham-Juberg	4/22/2004
Active	Schleichart	4/22/2004
Active	Van Offern	4/22/2004
Active	Antelope	9/13/2006
Active	Basin Valley	9/13/2006
Active	Cedar Canyon	9/13/2006

Allotment Status	Allotment Name	Most Recent Decision Date
Active	Ledbetter	9/13/2006
Active	Moulton	9/13/2006
Active	North Bonniwell	9/13/2006
Active	South Ashcroft	9/13/2006
Active	Southwest Bonniwell	9/13/2006
Active	Waugh	9/13/2006
Active	Belltower	1/7/2009
Active	Brewer	1/7/2009
Active	Byrne	1/7/2009
Active	Carter	1/7/2009
Active	Devils Creek-Neece	1/7/2009
Active	Gross	1/7/2009
Active	Kennedy	1/7/2009
Active	Lampkin Gulch	1/7/2009
Active	Plum Creek	1/7/2009
Active	East Trenk	5/19/2011
Active	Flastead	5/19/2011
Active	Harkins	5/19/2011
Active	North Trenk	5/19/2011
Active	Peabody	5/19/2011
Active	West Trenk	5/19/2011

Table 74. Active and vacant allotment decision dates (sorted oldest to newest) for Ashland Ranger District

Allotment Status	Allotment Name	Most Recent Decision Date
Active	Liscom Butte	6/9/1970
Active	Gold	1/9/1990
Active	South Lyon	6/1/1990
Active	Coyote	6/22/1992
Active	Cow Creek	8/19/1992
Active	Bloom Creek	9/8/1992
Active	Anderson-Diamond Butte	3/8/1996
Active	Ash Creek	3/8/1996
Active	Beaver Creek	3/8/1996
Active	Coal Creek	3/8/1996
Active	Cub Creek - A+E	3/8/1996
Active	Deer Creek	3/8/1996
Active	East Fork	3/8/1996
Active	East Home	3/8/1996
Active	Elk Creek	3/8/1996
Active	Elk Ridge	3/8/1996
Active	Fifteen Mile	3/8/1996

Allotment Status	Allotment Name	Most Recent Decision Date
Active	King Creek	3/8/1996
Active	North Lyon	3/8/1996
Active	Red Bull	3/8/1996
Active	Skinner Gulch	3/8/1996
Active	Ten Mile	3/8/1996
Active	Ten Mile - Three Mile	3/8/1996
Active	Upper Home	3/8/1996
Active	West O'dell	3/8/1996
Active	Whitetail	3/8/1996
Active	East Tooley	9/30/2003
Active	Indian Creek	9/30/2003
Active	Reanus	9/30/2003
Active	Stewart	9/30/2003
Active	Taylor Creek	9/30/2003
Active	3 X Bar	3/3/2005
Active	Brewster Gulch	3/3/2005
Active	South Lee Creek	3/3/2005
Active	Timber Creek	3/3/2005
Active	West Tooley	3/3/2005
Active	Brian-Gooseberry	9/18/2006
Active	East O'dell	9/18/2006
Active	Padget Creek	9/18/2006
Active	Stag Rock	9/18/2006
Active	Coleman Draw	1/20/2009
Active	Lower Home	1/20/2009
Active	Shorty Creek	1/20/2009
Active	West Home	1/20/2009

Table 75. Active and vacant allotment decision dates (sorted oldest to newest) for Beartooth Ranger District

Allotment Status	Allotment Name	Most Recent Decision Date
Active	Stillwater Bighorn Sheep Range	2/10/1989
Active	Bad Canyon	7/1/1992
Active	Sheep Creek	7/1/1992
Active	Crooked Creek	10/1/1992
Active	Wells	10/1/1992
Active	Dryhead	5/5/1997
Active	Bear Canyon	5/10/2004
Active	Big Pryor	5/10/2004
Active	Horseman Flat	11/15/2006
Active	Lodgepole	11/15/2006
Active	Pass Creek	11/15/2006
Active	Picket Pin	11/15/2006

Allotment Status	Allotment Name	Most Recent Decision Date
Active	Butcher Creek	4/28/2009
Active	East Rosebud	4/28/2009
Active	Red Lodge Creek	4/28/2009
Active	West Rosebud	4/28/2009
Active	Burnt Fork	7/6/2015
Active	Hogan Creek	7/6/2015
Active	Rock Creek	7/6/2015
Active	Sage Creek	7/6/2015
Vacant	Red Butte	7/6/2015

Table 76. Active and vacant allotment decision dates (sorted oldest to newest) for Yellowstone Ranger District

Allotment Status	Allotment Name	Most Recent Decision Date
Active	Lost Creek	12/17/1993
Vacant	Green Mountain	4/20/1995
Active	Lodgepole	9/20/1995
Active	Blind Bridger	10/15/1995
Active	Hubble	2/15/1996
Active	Big Creek	5/21/1996
Active	Pole Gulch	5/21/1996
Vacant	Mill Creek	6/14/1996
Active	Hawley	7/20/1996
Active	Rock Creek North	8/20/1996
Active	Porcupine	1/10/1997
Active	Otter Creek	2/15/1997
Active	Sunlight	3/15/1997
Vacant	Nurses Lake	9/20/1997
Active	Big Timber	1/15/1998
Active	Horse Creek	6/2/1998
Active	Little Timber	9/3/1998
Active	South Fk Of Shields	9/28/1998
Active	Deer Creek	11/15/1998
Active	Trail Creek	3/24/2000
Active	South Fork American	7/15/2002
Active	Mission Creek	8/14/2002
Active	Dry Creek	4/20/2006
Active	Fridley	4/20/2006
Active	Lewis	4/20/2006
Active	Sunnybrook	4/20/2006
Active	Crazy	6/5/2006
Active	Three Peaks	9/26/2006
Active	Bennett Creek	9/27/2006

Allotment Status	Allotment Name	Most Recent Decision Date
Active	Shields River	9/27/2006
Active	Smith Creek	9/27/2006
Active	Eightmile	8/14/2008
Active	West Pine	8/14/2008
Active	Carey Gulch	9/17/2012
Active	West Bridger	9/17/2012

Table 77. Active and vacant allotment decision dates (sorted oldest to newest) for Gardiner Ranger District

Allotment Status	Allotment Name	Most Recent Decision Date
Active	Green Lake	8/27/1992
Vacant	Mill Creek	11/21/1994
Active	Wigwam	11/24/1995
Vacant	Section 22	10/15/1996

Table 78. Active and vacant allotment decision dates (sorted oldest to newest) for Bozeman Ranger District

Allotment Status	Allotment Name	Most Recent Decision Date
Active	Pine Creek	9/10/1996
Active	Moose Creek	9/18/1996
Active	Pass Creek	9/18/1996
Active	Storm Castle	9/18/1996
Active	Weber	9/18/1996
Active	Big Bear	9/30/1997
Vacant	West Bridger Forage Reserve	9/30/1997
Active	Bear Canyon	3/24/2000
Active	Red Knob North	8/29/2003
Active	Alexander	9/24/2007
Active	Battleridge	9/24/2007
Active	Blacktail	9/24/2007
Active	Brackett Creek	9/24/2007
Active	Elk Ridge	9/24/2007
Active	Elkhorn	9/24/2007
Active	Flathead North	9/24/2007
Active	Flathead South	9/24/2007
Active	Middle Fork	9/24/2007
Active	Mill Creek	9/24/2007
Active	Troy	9/24/2007
Active	Bangtail	9/24/2009
Active	Jackson Creek	9/24/2009
Active	North Canyon	9/24/2009
Active	South Canyon	9/24/2009
Active	Willow Creek	9/24/2009

Table 79. Active and vacant allotment decision dates (sorted oldest to newest) for Hebgen Lake Ranger District

Allotment Status	Allotment Name	Most Recent Decision Date
Active	Moose	1/23/1996
Vacant	Sheep Mile Forage Reserve	1/16/1997
Active	Grayling Creek	4/17/1997
Active	North Cinnamon	3/25/1998
Active	South Cinnamon	3/25/1998
Active	Sage Creek	2/11/1999
Active	Taylor Fork	7/2/1999
Active	South Fork	9/13/2013
Active	Watkins Creek	9/13/2013

Since the current forest plans were signed in 1986 and 1987, animal unit months permitted on the Custer Gallatin National Forest have decreased 23 percent. Animal unit months permitted on the Gallatin portion of the Custer Gallatin National Forest have decreased 42 percent and animal unit months permitted on the Custer portion have decreased 19 percent. The changes in Gallatin units were primarily due to allotment closures of long-standing vacant allotments, as well as some stocking rate adjustments. The changes in the Custer units were primarily made to respond to range readiness issues, voluntary reductions coinciding with marketing timeframes, and carrying capacity/stocking rate issues.

Since the current forest plans were approved, there have been 59 allotment closures. Nine of the 59 closures were done through decisions made in the 1987 Gallatin For the foreseeable future, management under any of the alternatives Forest Plan while the remaining 50 have been closed since then. These allotments were vacated and closed for a variety of reasons. These include access issues, land exchanges, conflicts with wildlife values and grizzly bear conservation, and economic considerations.

These changes have occurred at a landscape level, while at an allotment level, some allotments have sustained little to no change in stocking rates since the plans were signed, while other allotments have undergone large stocking rate changes. Even though these changes over time helped make improvements to range condition in some areas, continued vigilance and adaptive management will be used to address issues and fine-tune management prescriptions. Attention is especially needed for:

- areas with season-long grazing,
- areas with long durations,
- during the fall when cattle diet preferences tend to switch more to browse species (such as green ash, willow or aspen),
- periods of time where distribution issues may arise in riparian or green ash draws (for example, during periods of hot season use),
- areas where stocking rates may not be in balance with carrying capacity, and
- areas with other resource considerations or concerns.

Because of the variability in sites, specific forage utilization guidelines for riparian areas, green ash woodlands, and uplands, as well as other monitoring metrics used along riparian green lines (such as utilization, stubble height and bank disturbance guidelines) are developed and recommended by an interdisciplinary team during the allotment planning process.

The current trend for most uplands is considered not apparent to upward. At more site-specific scales, actions continue to be implemented to improve conditions. In general, rangeland conditions overall have shown improvement over time. This is largely due to more recent improvements such as:

- cross-fencing to move most units from season long to rotation grazing,
- installing offsite water developments away from riparian and hardwood draw areas,
- shortening the season for range readiness,
- reducing stocking rates to be within capacity of the land,
- large-scale fires across landscapes, and
- implementing shorter duration grazing to provide more opportunity for plant recovery.

Trends in riparian conditions cannot be determined based on one site visit. Trends can generally be inferred (apparent trend), based on known changes in livestock management, or known disturbance events or trends can be factual, based on repeated, quantitative monitoring. Five percent of the riparian sites surveyed on the Custer Gallatin were considered to be in downward trend based on proper functioning condition protocol and data. In general, the apparent long-term trends for all riparian is up due to decreases in stocking rates over past decades, rest due to periodic non-use, and natural recovery from past wildfire events. However, the current short-trend for most reaches is considered not apparent since repeated measurements over time have not generally been done, although some monitoring sites are beginning to get repeat measurements.

3.14.3 Environmental Consequences

Current Plans

Management Direction under the Current Plans

The Custer Forest Plan goal for rangelands is to achieve a diversity of beneficial uses of rangeland resources, including an integrated management approach designed to attain healthy and productive soil and vegetation and water. Where necessary livestock management efforts will be intensified to allow for the improvement of vegetative condition and improve wildlife habitat. Land capabilities coupled with intensive management will dictate, on an allotment-by-allotment basis, the appropriate stocking level and the season of use. Livestock use levels are determined during allotment-specific analysis. The Gallatin Forest Plan goal for rangelands are to provide improved forage management to maintain or enhance the rangeland environment. Livestock grazing in riparian areas is to be controlled at levels of utilization that are listed for riparian management.

The current livestock grazing standard in the Custer Forest Plan is to follow the direction for grazing use within occupied grizzly bear habitat. The "Guidelines for Grizzly Bear Management in Greater Yellowstone Area" and Custer National Forest grizzly bear plan components will be the basis for resolutions of any conflicts between livestock and grizzly bears. The current livestock grazing standard in the Gallatin Forest Plan states grazing use will be guided by the Greater Yellowstone Area Grizzly Bear Conservation Strategy, where inside the primary conservation area or recovery zone for grizzly bears: (1) the number or acreage of active livestock grazing allotments above that which existed in 1998 is not to be increased, (2) vacant or closed sheep allotments are not to be reactivated, or (3) existing active or vacant cattle or horse allotments are not to be converted to sheep allotments.

Direction common to both the Gallatin and Custer Forest Plans includes:

- livestock use is not allowed in research natural areas unless permitted prior to the research natural area's establishment.
- existing grazing allotments within wilderness areas is to be managed in accordance with wilderness values.
- riparian areas are to be identified and mitigation implemented to retain unique riparian values during project-level allotment management planning for permitted livestock grazing. Adequate vegetation at the end of the growing season is important to provide streambank stability, protect streambanks from runoff events, and trap and filter potential sediment deposits. Desired vegetation that can meet these criteria are deep-rooted, water-loving species.

Direction in the Custer Forest Plan specifies green ash woodlands, also known as woody draws, are to be identified and mitigation implemented to retain unique values during project-level allotment management planning for permitted livestock grazing. In riparian and woody draw management areas, management practices such as fencing, grazing deferment, burning or planting may be tried on selected areas to determine their effectiveness in maintaining or improving green ash woodland or riparian conditions. Large-scale fencing efforts to protect these areas are generally not practical. Structural range improvements will be located to attract livestock out of this management area. Nonstructural range improvements will be done only to improve diversity of habitats or implement practices designed to restore the desired vegetative composition.

Effects of the Current Plans

Under the current plans, grazing management as outlined in the affected environment section would continue, with revisions of allotment management plans and associated protections for other resources following direction from the existing forest plans. Grazing management would continue to provide the livestock head months authorized in term Forest Service grazing permits. The current forest plans allowed for increasing the amount of animal unit months across the national forests, mainly from the transitory range being created from timber harvest. However, riparian and aquatic concerns would most likely keep permitted head months stable or slightly reduced as more allotment management plans are updated and management prescriptions are improved to move riparian areas toward desired conditions. The pasture configurations, quantity and size of grazing allotments could change from the current condition. Under the current plans, additional grazing allotments could be added if they were to meet the goals and guidelines of the existing management areas. Currently, there are no domestic sheep allotments on the Custer

Gallatin National Forest. Conversion from cattle to sheep allotments are not precluded in the current plans, except in the grizzly bear primary conservation area.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

The plan components are the same for the revised plan alternatives, and are designed to protect upland and riparian resources, manage noxious weeds, and maintain adequate levels of forage.

Collectively with the additional riparian management zone and other plan components, the grazing standards and guidelines generally would affect how allotment planning is designed and implemented so that future grazing would move resource conditions within allotments toward desired conditions.

Effects Common to the Revised Plan Alternatives

Desired conditions for livestock grazing emphasize sustainable grazing, stable soils, diverse vegetation and native plant communities, as well as riparian and wetland health. Movement toward these conditions would be achieved through implementation of the standards and guidelines for grazing and the other resource areas. Necessary changes to move towards desired conditions would be determined and implemented at the allotment management plan/project level.

For the foreseeable future, management under any of the revised plan alternatives would continue to provide forage production and productive livestock grazing. Acres available for livestock grazing and permitted animal unit months would be the same under all revised plan alternatives. None of the revised plan alternatives change existing allotment management or provide specific direction regarding current livestock management. No allotments or portions of allotments are proposed for closure to grazing due to other resource needs. Under all revised plan alternatives, changes to livestock management and allowable forage use levels at the site-specific scale would be made during allotment management plan revision. Furthermore, resource mitigations and best management practices are part of allotment plans designed to protect or mitigate forest resources from potential disturbances by livestock grazing. These elements are site-specific for each allotment and not part of this analysis.

Plan components emphasize improving riparian and wetland conditions and are expected to continue under all revised plan alternatives. Revisions of allotment management plans would continue to implement best management practices and identify end of season allowable use levels that are expected to move riparian areas toward desired conditions. Management adjustments may result in a loss of permitted animal unit months for some permittees.

Current vacant grazing allotments could be used as forage reserves (also known as grassbanks) for livestock from allotments affected by issues such as wildfire, drought, threatened and endangered species, or prescribed fire management. In these cases, permitted animal unit months would only be temporarily increased during the temporary period of reserve use. Some vacant allotments could be incorporated into adjacent allotments to help offset other resource considerations, typically done without increasing overall permitted animal unit months.

Conifer canopy closure, conifer and shrub encroachment into grasslands, and the spread of invasive weeds all have the ability to reduce available forage for livestock. The degree to which future management actions address each of these ecological processes would influence the potential loss or increase in available forage. Fire and physical manipulation of the tree overstory may help to maintain or increase forage productivity for browsing and grazing ungulates. Treatment of invasive weeds can allow desired natural plant communities to flourish. As a result of site-specific project-level analysis, permitted livestock numbers could decline in some areas due to more stringent management constraints for riparian areas as well as the loss of forage from invasive weed spread, and encroachment of conifers into some grassland communities. However, vegetation modeling (as discussed in the terrestrial vegetation section) indicates that the extent of non-forested plant communities overall would likely remain fairly constant under all alternatives, and forest densities may decrease. This may result in increased forage in some forested areas.

During the life of the plan, certain environmental influences may negatively impact rangeland health and forage production. As temperatures continue to increase, there may be changes in vegetation where there is a shifting from more mesic (moist) plant associations to more xeric (dry) communities that are better adapted to the drier sites. As a result, bare ground would likely increase within these plant communities as rangeland sites become drier during extended periods of drought (Pellant et al. 2004). Elevation will play a large role in plant species composition in conjunction with predicted climate change. High elevation, alpine, or other fringe-type environments may see plant species composition change first (Murphy and Weiss 1992). Invasive weeds would likely continue to spread and increase in abundance and density. Timber canopy may continue to close in areas where wildfires or other disturbances do not occur, and some grasslands and shrublands may see additional conifer encroachment and conversion to a conifer-dominated community. Conversely, it is likely that wildfire may play a larger role in shaping vegetation in some areas (Littell et al. 2018), perhaps promoting non-forested vegetation communities, particularly given warmer climate regimes. Transitory range acreage may fluctuate as forested stands become more open due to harvest, insects, disease, or fire. Over time and through succession, forest canopies would likely close in once again.

Climate change affects vegetation, which in turn could affect livestock grazing. Potential effects include, but are not limited to, changes in type, amount, and distribution of precipitation, which directly affects type, abundance, and distribution of vegetation. Lower-elevation grasslands and shrubland habitats are expected to become drier and habitat zones may shift upward in elevation (Finch 2012). The result of these potential changes could be an increase in suitable cattle forage, thereby causing increased forage for cattle grazing at higher elevations within an allotment. On the other hand, lower elevation rangeland and upland plant communities would be expected to wither and die earlier in the season, resulting in reduced palatability earlier in the grazing season. Reduced palatability in the uplands, combined with warmer temperatures would affect livestock distribution by concentrating livestock in riparian and wetland areas. Riparian use levels would be met earlier in the season, thus forcing livestock to be removed from an allotment or pasture earlier than the permitted off date.

Increases in atmospheric carbon levels and higher temperatures would likely make invasive species, especially annual grasses, more competitive and adaptable, which may allow some species to expand to higher elevations as well as become more difficult to control due to reduced chemical efficacy (Ziska et al. 2004). Not only will some species become more invasive, but the array of species would continue to change (Scott et al. 2013).

It is possible for climate change to impact resource use within a short timeframe, which could change the suitability and utilization of forage. For example, there have been periods of increased summer temperature and decreased summer precipitation over a 15- to 20-year planning period, which would indicate that the potential for changes in the suitability and utilization of forage within a grazing allotment may change within a planning period. This could cause beneficial or negative impacts to the permitted use of a grazing allotment for suitability and utilization. Annual fluctuations of temperatures and precipitation would affect forage palatability under all alternatives.

Though the impacts to livestock grazing from climate change remain to be fully understood or experienced by permittees of the Custer Gallatin National Forest, the Forest Service has administrative tools to adapt to unexpected conditions as well as short and long-term changes in resource conditions. Examples of administrative changes include stocking adjustments and adjusting management practices through permit modifications and/or annual operating instructions. The impact of climate change to livestock grazing could include limited use of allotments due to less available forage and/or seasonal changes in palatability.

Effects that Vary Among the Alternatives

In the short term, all alternatives are designed to maintain forage production and livestock grazing. All alternatives have similar vegetation treatment levels, which could be favorable for livestock permittees as herbaceous forage should temporarily increase after treatments. The revised plan alternatives would not reduce livestock grazing, but would have more area in recommended wilderness and backcountry areas than the current plans, where access for permittees could be more limited or require higher authorization scrutiny in regards to the use of motor vehicles for permit administration. See table 81 for which allotments occur in recommended land allocations.

The objective of providing animal unit months as currently permitted (213,802) and as vacant allotment capacity would allow at some future point (5,504 AUMs) would be the same under the current plans and alternatives B and C. The objective for alternative D would be to provide animal unit months as currently permitted and the vacant allotment capacity may not be reactivated due to other resource considerations such as forage reserves, at-risk species habitat needs, or other conservation needs. The objective for alternative E would be to provide animal unit months as currently permitted and the vacant allotments may not be reactivated due to this alternative’s lower budget projections for allotment administration. Under all alternatives, the permitted use of the existing active grazing allotments would continue. However, animal unit month levels may be reduced as site-specific allotment changes are needed. Based on current rangeland and riparian conditions and the need to revise or review allotment management plans for allotments, changes in the amount of permitted animal unit months are difficult to predict. Project-level analysis and allotment-specific monitoring will determine site-specific prescriptions, future stocking rates, and other management adjustments to meet desired conditions under all alternatives. Permitted animal unit months over the long term could possibly decrease under all alternatives due to more intensive management of riparian areas or habitats for threatened, endangered, or at-risk species.

Infestations of noxious weeds can substantially impact livestock grazing if they are extensive and dense enough to reduce the amount of available forage. Any ground-disturbing activity has the potential to expose a site to noxious and invasive plants, particularly when motor vehicles are involved. Conversely, established motorized access can make noxious and invasive plant treatment much easier and cost effective. Even though grazing can be used as a noxious weed and invasive species control mechanism, there is potential of spreading undesired species to other areas within the Custer Gallatin without the use of mitigations. The alternatives vary slightly in their potential for ground-disturbing activities such as timber harvest and prescribed fire, with alternative E predicted to have the least amount. Similarly, the potential for motorized access also varies to a limited extent, based primarily on whether existing motorized uses are allowed in recommended wilderness areas or backcountry areas, especially under alternative D. However, for both ground-disturbing activities and motorized access, the differences between the alternatives are slight in respect to the potential to impact rangeland condition and trend. These differences are negligible at the programmatic scale.

Consequences to Permitted Livestock Grazing from Forest Plan Components Associated with Other Resource Programs or Management Activities

Effects from Timber, Vegetation, Fuels and Fire Management

Vegetation management, such as timber harvest and prescribed fire, can provide transitory range that would be available for livestock and wildlife grazing. Transitional range forage capacity decreases over time as the forest overstory grows back and shades out the herbaceous understory. As timber is harvested, areas may open up to livestock that were not previously available thus increasing capable grazing acres. These newly accessible areas would be used as transitory range as long as the acreage occurs within an existing allotment. Timber harvest could also open up range that is inaccessible to livestock because of natural barriers. This could cause livestock control and management problems if the previously unharvested timber stands were used as natural barriers between allotments or other critical area. If this were to occur, additional range improvements would need to be installed to control livestock. In addition, if livestock use is inhibiting regeneration of trees (through trampling or grazing), livestock may need to be temporarily excluded from these areas, which would offset potential gains in transitory range for a time.

Projected acres of vegetation management using timber or fuels treatments are used to compare the relative probability of creating transitory range across alternatives. Alternative D would have the most acres of vegetation treatment and, therefore, would be the most likely to create transitory rangeland. Transitory rangeland temporarily provides capable rangeland but conifer regeneration would slowly come back into the harvest units over the next approximately 10 to 20 years and would only provide increased forage during that timeframe. However, transitory range would help grazing allotments by providing increased forage and additional foraging areas which would have been inaccessible or void of herbaceous forage prior to timber harvest.

Opportunities for vegetation management that include reducing conifer encroachment and restoring aspen and woody draw stands would have beneficial effects on livestock grazing. The predominant understory vegetation in conifer encroachment areas would respond favorably to conifer removal and provide forage for livestock, big game, and wildlife habitat.

A flush of forbs and grasses occurs especially after a prescribed burn and to a lesser extent after other conifer removal methods. The increase in production in these cases can last for many years or even decades. Aspen and woody draw restoration would also increase forage, but treatments and post-treatment project design criteria must account for the potential for heavy browsing and trampling. Cattle may be fenced from treatment areas or physical barriers be placed/felled, or pastures placed in non-use or prescribed rest until sprouts escape the browse zone from livestock and wildlife. Once stands have recovered, understory vegetation would be favorable for providing forage for livestock, big game and wildlife habitat.

All alternatives have similar potential to promote aspen and woody draws and reduce conifer encroachment, although the revised plan alternatives have more explicit desired conditions related to aspen woody draws and non-forested plant communities.

Fire and fuels management can have different short-term and long-term effects on livestock grazing. Effects depend upon burning conditions and burn type, and the results and timing of a wildfire are much less predictable compared to a prescribed fire. Prescribed burning often results in an increase in forage production and availability, and a shrub community more compatible with a variety of wildlife species. A reduction in shrub and conifer density could potentially accelerate the recycling of nutrients and make water more accessible across the landscape, such as in springs, seeps, and intermittent streams. Wildland fire can temporarily increase forage on an allotment, which, in turn can provide more flexibility for livestock management, improve livestock or wildlife distribution, and increase available animal unit months. Underburns in conifers or other types of burns can increase forage production and accessibility. Areas that are typically grazed may have use deferred prior to a prescribed burn to ensure there is sufficient fine fuels to meet the burn objectives, and use deferred following a prescribed burn to allow for vegetation recovery depending upon local conditions. This deferment requires that the permittee be flexible in management and involved in considerable advance planning and coordination. If a prescribed fire does not take place on schedule, arrangements need to be made again in successive attempts, which could accrue additional costs to the permittees and the Forest Service.

A wildfire can have similar effects as prescribed fire, but is likely to have unplanned adverse effects as well. Wildfire may result in the entirety of an allotment being burned, resulting in forage unavailability, with permittees being forced to move livestock to other lands in their operation (such as private or state). On rare occasions, large, quick-moving wildfires may also overrun livestock that cannot escape, which results in direct financial loss for a permittee. Wildfire may remove allotment infrastructure, which results in direct financial loss for the Forest Service and permittees. Wildfire may remove trees and open forest understories to a flush of grass and forb production for many years. Similar to prescribed fire, wildfire can have the effect of recycling nutrients and improving the quality and quantity of forage for livestock and wildlife. However, since timing, location, and burn conditions are not controllable, wildfires are less likely to provide the same amount of positive effects as prescribed burns.

To evaluate the potential impact of fire on livestock grazing, the projected acres of wildland fire are used to determine areas most likely to create more suitable forage. Expected wildfire will continue to a similar degree under all alternatives because of both natural and human-caused ignitions, an expansive fuel source, and climate effects. It cannot be predicted with high accuracy where and when fires will occur. There is a high degree of variation, spatially and temporally, in the amount and location of fire. The projected acres of prescribed fire range from about 24,000 to 38,000 fire acres per decade over the next 50 years. Projected acreage of prescribed burning on forested lands are similar for the current plans and alternatives B and C, while alternative E is less and alternative D would have the most expected acreage.

Fire would need to be within an existing allotment to affect the amount of forage for livestock grazing and allotment infrastructure. The differences in the expected acreages of wildland fire are negligible at the forestwide scale in the long term, and therefore the potential effects would be similar across all alternatives. All alternatives have plan components that are generally permissive to the use of prescribed fire on the landscape.

Effects from Watershed, Aquatic, Riparian, and Soil Management

The aquatics and terrestrial vegetation sections discuss the effects of plan components on aquatic resources, particularly riparian areas. Management and protection of riparian and wetland resources are emphasized under all alternatives. The watershed and fisheries plan components, under the current plans and the revised plan alternatives have had and would continue to need vigilant compliance monitoring in relation to livestock management. The objectives and standards for protecting riparian and wetland resources have some of the greatest influences relative to the permitted livestock grazing in achieving desired conditions. Changes have been made in grazing management and practices to protect riparian and wetland resources, which are reflected in current resource conditions. Over the last 20 years, much has been accomplished by altering grazing practices to protect riparian and aquatic resources. This has occurred through allotment management plan revisions throughout the Custer Gallatin as well as implementation of site-specific mitigations determined during allotment management plan analysis. However, efforts still need to be implemented on many allotments to move toward desired riparian conditions while maintaining permitted grazing.

Methods available to monitor grazing in riparian areas are varied and being improved (Bryant et al. 2004, Kershner et al. 2004a, Coles-Ritchie et al. 2007, Burton et al. 2008, Al-Chokhachy et al. 2010, Hough-Snee 2013, Batchelor et al. 2015, Laine et al. 2015). While no one method works everywhere, stubble height has been extensively studied and is widely put in practice as an end-of-season monitoring indicator (Clary and Webster 1990, Clary and Leininger 2000, Goss and Roper 2018).

End of season stubble height of greenline vegetation has been shown to be a good indicator of two primary factors: (1) the effect of grazing on the physiological health of herbaceous, hydrophilic plants, and (2) the ability of the vegetation to provide streambank protection and bank building function during the following spring’s peak flows. Stubble height criteria should be used where streambank stability is dependent upon herbaceous plants. Alternatively, woody plant utilization or streambank alteration could be used as a management guide in situations where streambank stability is controlled by substrate or the stream is deeply incised (Clary and Leininger 2000, Clary and Kinney 2002).

To maintain or improve riparian aquatic habitat and achieve riparian habitat desired conditions specific to an ecological site over time, all revised plan alternative plan components direct that low gradient, alluvial channels should have end of season stubble height of hydrophilic vegetation along the greenline to be at least 4 to 6 inches. Alternative use and disturbance indicators and values may be used if they are based on site capability, relevant science, monitoring data, and meet the purpose of this guideline. This is based on Rosgen C and E stream channel classes (Rosgen 1996), which are streams that rely heavily upon the hydrophilic streambank vegetation and associated root strength to maintain or improve streambank stability. A 4 percent or less perennial stream gradient is a characteristic of Rosgen C and E stream channels. It is estimated that about 150 to 175 miles of perennial streams with a 4 percent or less gradient are found within allotment primary projected to be beneficially affected by the revised plan alternatives' stubble height plan component. In turn, permittees may potentially be required to move off an area earlier than permitted. Permittees may also be affected financially or by increased labor requirements. Monitoring may indicate that changes in grazing prescription (timing, duration, intensity of use, or off-site water developments) or permitted stocking are needed. Modifications to permits can be done at any time when monitoring information indicates a need for a new term or condition of the permit.

Physical factors such as stream type, geology, climate, and elevation greatly influence the recovery of riparian areas. Specific management action must be made to fit local conditions (Clary and Webster 1990), which also includes selecting annual use indicators that match the resource goals of a riparian site. Riparian grazing plans should be site-specific and based upon the best research and evidence available to maintain and enhance vegetation and protect streambanks (Mosley et al. 1997). Allotment management plans for livestock provide specific operational guidance and are the most appropriate planning level to implement management tools such as minimum stubble height, multiple-year mean utilization, or streambank alteration limitations (FSH 1909.12 23.22e).

Under the revised plan alternatives, stubble height guidelines would be implemented in all allotments and could increase the amount of management needed within allotments to meet desired conditions. Under all alternatives, other best management practices would be implemented to mitigate livestock impacts where they are present and if riparian areas are not meeting desired conditions.

Many variables impact the effectiveness of action by the permittee and the agency to comply with plan components. Site-specific riparian allowable use levels have been effective to move riparian condition in an upward trend. Under all alternatives, a strong commitment is needed by both the grazing permittee and agency to implement, monitor, and provide accountability for allowable use levels to be successful. Overall, effects of plan components guiding end of season riparian stubble height and limiting livestock handling facility construction within riparian management zones would be similar under all revised plan alternatives.

Effects to riparian habitat would likely not vary for livestock grazing under any plan revision alternative. Over time, conditions in riparian management zones as well as aquatic habitat within grazing allotments are expected to improve over current conditions.

Under all alternatives, soil plan components would place limitations on detrimental soil conditions. These measures may potentially place limitations on grazing, but impacts from prescribed grazing seldom exceed detrimental soil condition standards. Protecting soil productivity would help provide for better upland and riparian management zone conditions in the long term.

Effects from Wildlife Management

Grazing livestock share habitat resources with big game and other wildlife species. Big game grazing and browsing can be compatible with livestock grazing and browsing. Elk grazing patterns have been influenced by cattle grazing, depending upon grazing season, intensity of grazing vegetation types, available vegetation and its spatial distribution, and other environmental factors as they seek areas of forage regrowth following grazing by livestock. Crane (Crane et al. 2001), found that in the fall and winter, elk preferred to forage where cattle had lightly or moderately grazed the preceding summer, while in spring, elk strongly preferred to graze where cattle had grazed moderately during the preceding summer. Their results indicate that prescriptive cattle grazing can encourage or discourage where elk graze in rangeland landscapes. In southern Colorado, Hansen and Reid (Hansen and Reid 1975), found a range of overlap in summer diets of elk and cattle from 30-51 percent. Vavra et al. (1989) also noted the variability associated with seasonal differences in their 55-76 percent range of dietary overlap values found in eastern Oregon. In the Red Desert of Wyoming, Olsen and Hansen (1977) examined diets of elk and cattle for each season and determined a 25-85 percent range of overlap. In northwestern Wyoming it was found that in all seasons, elk and cattle consumed grass-dominated diets although elk diets were more diverse, and that mule deer consumed more forbs and shrubs than either elk or cattle (Torstenson et al. 2006). While several studies indicate dietary overlap is likely, the degree varies by area and among seasons (Clegg 1994). A study by Damiran and others (2003) suggests that early summer grazing by cattle or elk at the moderate utilization level has very little effect on the subsequent foraging efficiency of deer and elk. In addition, early summer grazing by cattle can improve the quality of subsequent elk diets, but early summer grazing by elk may reduce subsequent diet quality for cattle, deer, and elk.

Current forest plans and allotment management plans for most Custer Gallatin National Forest allotments identify and manage for wildlife forage needs, such as crucial winter range and limiting interactions between permitted livestock and bighorn sheep to avoid disease transmission, and would continue to do so under all alternatives. Allotment management plans have adjusted grazing management prescriptions accordingly where allotment boundaries overlap with known big game winter range by decreasing permitted livestock use and attempting to increase livestock distribution. In certain site-specific cases, such as localized population fluctuations or a distribution shift due to habitat loss on historic winter range, future limitations could be placed on forage use by permitted livestock through the allotment management plan revision process or permit modification due to monitoring results to assure adequate forage for the wild ungulate populations. Most allotments would have the flexibility to adjust permitted livestock distribution if needed for adequate winter range forage. Upland use levels are rarely exceeded, let alone approached on most Custer Gallatin National Forest allotments, as riparian areas primarily drive management actions. Plan components in all alternatives associated with big game habitat management should not limit livestock forage opportunity and not affect permitted use, suitability, and utilization within the grazing allotments to a great degree.

Key Linkage Areas

Linkage areas support seasonal, exploratory, or dispersal movements of animals beyond the home range and facilitate demographic and genetic connectivity between geographically separate patches of habitat. A key linkage area has been identified near the Custer Gallatin National Forest boundary in the Bridger Mountains north of Bozeman and near Bear Canyon and Trail Creek southeast of Bozeman, where wildlife movement is desirable for genetic exchange between blocks of public lands. Components in the revised plan alternatives require that management activities in key linkage areas include design features to restore, maintain or enhance habitat connectivity to facilitate daily and seasonal movements. New permanent facilities and structures, such as fences or stock driveways, are not be constructed unless needed to address ongoing or imminent resource concerns with the key linkage area, including but not limited to degradation of wildlife habitat connectivity.

Key linkage area plan components could preclude any new allotment fence construction or would require design features such as a “let-down” fence design to prevent barriers to wildlife movement. The following table displays the allotments that could be affected, the associated amount of primary rangeland, and allotment infrastructure. At least seven permittees could potentially be affected by higher administrative costs associated with labor and cost of letting new fence down and putting new fence up at the end and beginning of each grazing season.

Table 80. Allotments and associated infrastructure within key linkage areas

Geographic Area	Allotment and Primary Rangeland	Current Infrastructure
Absaroka-Beartooth Mtns	Bear Canyon; majority of primary rangeland	No infrastructure
Absaroka-Beartooth Mtns	Trail Creek; minor portion of primary rangeland	One water development and no fence
Bridger, Bangtail, Crazy Mountains	Blacktail; majority of primary rangeland	2 water developments and 0.5 mile of fence
Bridger, Bangtail, Crazy Mountains	Pass Creek; majority of primary rangeland	No water developments and 0.25 mile fence
Bridger, Bangtail, Crazy Mountains	Mill Creek; majority of primary rangeland	1 water development and 0.5 mile of fence
Bridger, Bangtail, Crazy Mountains	Reese on/off; majority of primary rangeland	No water developments and 0.2 mile of fence
Bridger, Bangtail, Crazy Mountains	West Bridger; majority of primary rangeland	No water developments and 3.2 miles fence

Grizzly Bears

All alternatives would include the adoption of the Grizzly Bear Conservation Strategy. Potential for grizzly bear-livestock conflicts exist where grizzly bear habitat and livestock operations overlap on both National Forest System lands as well as outside the national forest boundary. Historically, grizzly bear and livestock conflicts have been rare under current management.

Potential for grizzly bear-livestock conflicts would be mitigated to the best possible extent while continuing to authorize permitted livestock grazing under the alternatives. Permitted livestock grazing would continue to be guided by the Greater Yellowstone Area Grizzly Bear Conservation Strategy where inside the primary conservation area or recovery zone for grizzly bears:

- the number or acreage of active livestock grazing allotments above that which existed in 1998 is not to be increased,
- vacant or closed sheep allotments are not to be re-activated, and
- existing active or vacant cattle or horse allotments are not to be converted to sheep allotments.

The Custer Gallatin National Forest would continue to allow livestock grazing in the 19 allotments in the primary grizzly bear conservation area (see volume 2, appendix A – Maps). There are no permitted sheep allotments within the primary conservation area nor the remainder of the national forest.

No matter what the strategy or alternative selected, having a sustainable population of grizzlies in the same mountain ranges as permitted livestock will probably result in depredation of livestock at some point. This may increase operating costs and stress for permittees, as some level of livestock death loss may be inevitable under all alternatives.

Bison

On the Hebgen Lake Ranger District, there are two active horse allotments within western bison zone 2, four active horse allotments within the western year-round bison tolerance zone, and two active cow/calf pair allotments and one vacant cow/calf pair allotment outside of but near the western bison management zones to the south and west. On the Gardiner Ranger District, there are two active (6/16 grazing season entry dates) and three vacant cow/calf pair allotments within the northern bison tolerance zone and three active cow/calf pair allotments in Tom Miner Basin outside of but near the northern bison management zones. Plan components are consistent with the current Interagency Bison Management Plan. The Interagency Bison Management Plan allows it to be modified based on science and management directions set by Animal Plant Health Inspection Service and by the State Department of Livestock.

Plan components allows for flexibility in allotment management planning to accommodate changes in bison management. Alternatives B, C, and D favor bison and alternative E favors livestock in case of conflicts. The Custer Gallatin National Forest can consider various options with grazing permit holders to alleviate potential bison/livestock conflicts. This may include adaptive management National Environmental Policy Act decisions such as authorizing a change in the kind of livestock from cow/calf pairs to horses or steers; or turn cattle out on the allotment later in the season when the transmission of brucellosis is not likely (for example, after July 15), non-use for resource protection, or other identified opportunities.

Bighorn Sheep

Disease transmission from domestic animals, particularly domestic sheep and goats, is considered a primary threat to bighorn sheep populations. Since there are no permitted domestic sheep or goat allotments on the Custer Gallatin National Forest, there would be no direct effects on associated permittees. Currently, sheep or goat permits are not allowed in the grizzly bear primary conservation area and that direction would remain under all alternatives.

Under alternative D, there would be an indirect effect of precluding any future domestic sheep or goat permitted use on the Custer Gallatin National Forest. Under alternatives B and C, there would be an indirect effect of precluding any future domestic sheep or goat permitted use in the Pryor Mountains, Absaroka-Beartooths, and Madison, Gallatin, Henrys Lake Geographic Areas. In the Bridger/Bangtails/Crazy Mountains, Ashland, and Sioux Geographic Areas, alternatives B and C would require a site-specific risk assessment prior to determining whether to authorize sheep or goat occupancy by permit. Alternatives A and E would require a site-specific risk assessment prior to determining whether to authorize sheep or goat occupancy by permit anywhere on the national forest.

Greater Sage-grouse

The greater sage-grouse is one of the species of conservation concern identified by the Regional Forester. The sagebrush habitat components are important for this species persistence because greater sage-grouse are sage obligates. The primary concerns for sage-grouse are loss and fragmentation of their habitat. There are approximately 2,200 acres of priority habitat in four allotments (Sioux Ranger District – Cedar Canyon, South Ashcroft, and minor amounts in North Ashcroft and Bye-Mrizek allotments) while there are about 123,400 acres of general habitat in 49 allotments in the Pryor Mountains, Ashland, and Sioux Geographic Areas. Plan components in the revised plan alternative direct that vegetation management will be beneficial to greater sage-grouse and no net loss of habitat. In addition, new range management structures (such as fences, stock tanks, and other features) are to be designed and located to be neutral or beneficial to greater sage-grouse (for example, use visual fence markers to minimize greater sage-grouse collisions with fences). These plan components and management approaches may affect timing, duration, and intensity of livestock grazing as well as the infrastructure used for site-specific management on 49 allotments in the Pryor, Ashland and Sioux Geographic Areas. Management approaches in the draft revised plan appendix A, outline possible ways to reduce impacts from grouse collisions by using fence markers within a half a mile of leks on flat or gently rolling terrain. In addition, when planning new fence projects, fence siting should avoid high-risk areas to minimize risk of collision.

Bats

Bats typically drink on the fly and are vulnerable to obstructions such as barbed wire across natural water sources (such as ponds, or pools in creeks) and artificial water sources such as stock tanks. Management approaches in the draft revised plan appendix A, outline possible ways to reduce impacts from bat collisions by design considerations that place barbed wire away from water openings, and using escape ramps in stock tanks to reduce incidences of drowning.

Effects from At-Risk Plant Species Management

Protection of at-risk plant species habitat has an influence on livestock grazing. Intensive management can generally be successful in moving resource conditions towards desired condition, but instances may arise where reduced stocking levels or other mitigation measures are needed. At this time, predicting any future reductions are outside the scope of this analysis but would be addressed with site-specific analyses if species are listed.

Although known at-risk plant occurrences are minimal in size and abundance within primary rangelands, livestock can contribute to the deterioration of the quality of at-risk plant habitat through improper grazing or physical contact (such as hoof action). In cases where the level of impact is unacceptable, the impacts can be mitigated with fencing or with changes in management (intensity or timing).

Under all alternatives, plan components are in place to ensure the protection of threatened, endangered, or at-risk plant species. The potential for these effects is the same for all alternatives.

Effects of Land Allocations

Designated Wilderness

The two designated wilderness areas on the Custer Gallatin National Forest, designated by Congress, are the Absaroka Beartooth and Lee Metcalf Wildernesses. These allocations would be the same for all alternatives. Nine allotments lie partially within wilderness areas on the Custer Gallatin National Forest. One allotment is within the Lee Metcalf Wilderness and eight allotments are within the Absaroka Beartooth Wilderness. Minor infrastructure associated with the management of these allotments includes fences, water lines, and water tanks. In designated wilderness, livestock grazing “and activities and the necessary facilities to support a livestock grazing program, would be permitted to continue in wilderness areas, when such grazing was established prior to classification of an area as wilderness” in accordance with Congressional Grazing Guidelines (FSM 2323.2, WO Amendment 2300-90-2). There is to be “no curtailment of grazing permits or privileges in an area simply because it is designated wilderness.” Wilderness designation should not prevent the maintenance of existing fence or other livestock improvements, not the construction and maintenance of new fences or improvements which are consistent with allotment management plans and/or which are necessary for the protection of the range.” However, travel variances would need to be issued to permittees for motorized access to administer their allotments, and would also be subject to line officer approval. The following table displays the permits affected and the relative amount of primary range and infrastructure within wilderness.

Table 81. Custer Gallatin National Forest allotments located partially within wilderness areas (all alternatives)

Wilderness Area	Geographic Area	Allotment
Absaroka-Beartooth	Absaroka Beartooth	Grouse Creek: a portion of the allotment and primary range is in the Wilderness Area. No infrastructure
Absaroka-Beartooth	Absaroka Beartooth	Hawley: a portion of the allotment and primary range is in the Wilderness Area. No infrastructure
Absaroka-Beartooth	Absaroka Beartooth	Lost Creek: a major portion of the allotment and primary range is in the Wilderness Area along with 1.0 mile of fence.
Absaroka-Beartooth	Absaroka Beartooth	Main Boulder: a minor portion of the allotment but no primary range is in the Wilderness Area. No infrastructure.
Absaroka-Beartooth	Absaroka Beartooth	Deep Creek South: the entire allotment and primary range is in the Wilderness Area. No infrastructure
Absaroka-Beartooth	Absaroka Beartooth	Sixmile South: a portion of the allotment and primary range is in the Wilderness Area along with 0.2 mile fence and one water development.
Absaroka-Beartooth	Absaroka Beartooth	Suce Creek: a portion of the allotment and primary range is in the Wilderness Area along with 0.8 mile pipeline.
Absaroka-Beartooth	Absaroka Beartooth	Slip and Slide: a minor portion of the allotment and primary range is in the Wilderness Area. No infrastructure
Lee Metcalf Wilderness	Madison, Henrys Lake, Gallatin	Sage Creek: a major portion of the allotment and primary range is in the Wilderness Area. No infrastructure

Wilderness Study Area

The Hyalite, Porcupine, Buffalo Horn Wilderness Study Area (156,203 acres) was designated by Congress. Portions of seven allotments occur within this area under all alternatives. Allotment infrastructure maintenance and allotment administration continues to be suitable in those portions of the wilderness study area. Some on-the-ground management practices, especially concerning motorized travel, would continue to be subject to review for authorization. All of this area is also classified as inventoried roadless area where the setting is semi-remote / primitive, which would not result in substantial travel or access changes as a result of this designation.

The following lists allotment primary rangeland and infrastructure in the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area for all alternatives:

- Tom Miner Ramshorn: a portion of allotment and primary range within the wilderness study area, along with one water development.
- Lewis Creek: a portion of allotment and a minor amount of primary range with the wilderness study area.
- Big Creek: a portion of allotment and a major portion of primary range within the wilderness study area, along with 3 water developments and pipeline.
- Fridley: minor portion of allotment and primary range in wilderness study area.

- Pole Gulch: minor portion of allotment and no primary range in wilderness study area.
- North Dry Creek: minor portion of allotment and primary range in wilderness study area.
- Eightmile: minor portion of allotment and primary range in wilderness study area.

If the wilderness study area designation were released by Congress, the revised plan alternatives propose a range of potential land allocations that would continue to allow for permitted livestock use and allotment infrastructure maintenance, although motorized use in resulting recommended wilderness or backcountry areas would be subject to review for administrative motorized travel authorization for some on-the-ground management practices.

If Congress released the wilderness study area in the future, resulting land allocations could continue to affect:

- at least three permittees with allotments in recommended wilderness areas under alternative B,
- three in recommended wilderness areas and three in backcountry areas under alternative C,
- six in recommended wilderness areas under alternative D, and
- five in backcountry areas under alternative E.

Table 82 indicates relative amount of allotments and infrastructure where administration and maintenance could be affected by increased review for administrative motorized use in these areas.

Recommended Wilderness and Backcountry Areas

Motorized access for allotment administration is allowed to continue for maintenance of allotment infrastructure in allotments within recommended wilderness areas and could be subject to increased review for administrative motorized travel authorization. This land allocation could affect cost and labor of allotment operations and infrastructure maintenance to at least five permittees under alternative B, four permittees under alternative C, and 80 permittees under alternative D. Some allotments may be potentially more difficult to administer if a travel variance to use motor vehicles is not authorized. Table 83 displays allotments by alternative in recommended wilderness areas.

Motorized access for allotment administration is allowed to continue for maintenance of existing allotment infrastructure in allotments within backcountry areas, but administrative motorized use on new allotment infrastructure would be subject to increased review for use of motorized travel and equipment needed for maintenance. This land allocation could affect cost and labor of allotment operations and infrastructure maintenance to at least 11 permittees under alternative B, 36 permittees under alternative C, 21 permittees under alternative D and five permittees under alternative E. Table 84 displays allotments within backcountry areas by alternative.

Table 82. Allotment primary rangeland and infrastructure in resulting land allocations if Hyalite-Porcupine-Buffalo Horn Wilderness Study Area were released by Congress

Land Allocation	Geographic Area	Allotment, Primary Range and Infrastructure
Gallatin Crest Recommended Wilderness Area (RWA)	Madison, Henrys Lake, Gallatin	Alternative B • Tom Miner Ramshorn: a portion of allotment and primary range within the RWA, along with one water development. • Lewis Cr: a portion of allotment and a minor amount of primary range with the RWA. • Big Creek: a portion of allotment and a major portion of primary range within the RWA, along with 3 water developments and pipeline.
Gallatin RWA	Madison, Henrys Lake, Gallatin	Alternative C • Tom Miner Ramshorn: A portion of the allotment and primary range within the RWA; 0.1-mile fence and one water development. • Lewis Creek: a portion of allotment and a minor amount of primary range with the RWA. • Big Creek: a portion of allotment and a major portion of primary range within the RWA, along with 3 water developments and pipeline.
Gallatin RWA	Madison, Henrys Lake, Gallatin	Alternative D • Tom Miner Ramshorn: A portion of the allotment and primary range within the RWA; 0.1-mile fence and one water development. • Lewis Creek: a portion of allotment and a minor amount of primary range with the RWA. • Fridley: minor portion of allotment and primary range in RWA. • Pole Gulch: minor portion of allotment and no primary range in RWA. • North Dry Creek: minor portion of allotment and primary range in RWA. • Eightmile: minor portion of allotment and primary range in RWA.
Hyalite-Porcupine-Buffalo Horn Backcountry Area (BCA)	Madison, Henrys Lake, Gallatin	Alternative E • Tom Miner Ramshorn: a portion of allotment and primary range within the BCA, along with one water development. • Lewis Creek: a portion of allotment and a minor amount of primary range with the RWA. • Big Creek: a portion of allotment and a major portion of primary range within the RWA, along with 3 water developments and pipeline. • North Dry Creek: a portion of the allotment but no primary range are in the BCA. • Eightmile: a portion of the allotment and primary range are in the BCA
Buffalo Horn BCA	Madison, Henrys Lake, Gallatin	Alternative E • Tom Miner Ramshorn: portion of allotment and primary range (both NFS and Private) in BCA and one water development. • Lewis Creek: portion of allotment in BCA; no primary range or infrastructure. • Big Creek: portion of allotment and large amount of primary range in BCA, including 4 water developments.
West Pine BCA	Madison, Henrys Lake, Gallatin	Alternative C • N. Dry Creek: entire allotment and primary range in BCA along with 0.6-mile fence and two water developments. • Eightmile: entire allotment and primary range in BCA along with 0.6-mile fence and two water developments. • Pole Gulch: minor portion of allotment and no primary range in BCA.

Table 83. Allotment primary rangeland and infrastructure in recommended wilderness areas (RWA)

Land Allocation	Geographic Area	Allotment Primary Range and Infrastructure
Tongue River Breaks RWA	Ashland	Alternative D • W. O'Dell: major portion of allotment and primary range in the RWA along with 11 water developments and 7 miles of fence.
King Mountain RWA	Ashland	Alternative D • King Creek: Major portion of allotment and primary range in the RWA, along with 16 water developments and 19 miles of fence.
Cook Mountain RWA	Ashland	Alternative D • Ash Creek: major portion of allotment and primary range in the RWA along with 17 water developments and 3 miles of fence.
Big Pryor RWA	Pryor Mountains	Alternative D • Crooked Cr: minor portion of allotment; no primary range within RWA. • Sage Creek. a portion of the allotment and minor primary range in the RWA along with 0.3 mile of fence and 6 water developments. • Big Pryor: a portion of allotment and primary range in the RWA along with 6 water development and 3.0 miles of fence.
Punchbowl RWA	Pryor Mountains	Alternative D • Dryhead: the entire allotment and primary range are within the RWA. • Wells: Almost entire allotment and primary range with 1.7-mile fence and one water development within RWA. • Sage Creek: minor portion of allotment and primary range within RWA • Crooked Creek: a portion of allotment and primary range within RWA along with one water development.
Bear Canyon RWA	Pryor Mountains	Alternative D • Bear Canyon: Major portion of allotment and primary range within RWA, along with 7 water developments and 2.5 miles of fence.
Lost Water Canyon RWA	Pryor Mountains	Alternatives B and C. • No Allotments or infrastructure
Lost Water Canyon RWA	Pryor Mountains	Alternative D • Crooked Cr: a portion of allotment and primary range within RWA along with one water development.

Land Allocation	Geographic Area	Allotment Primary Range and Infrastructure
Crazy Mountains RWA	Bridger, Bangtail, Crazy Mountains	Alternative D • Big Timber: a portion of allotment and primary range in the RWA along with 0.2 mile of fence. • Otter Creek: a portion of allotment and primary range in the RWA along with 0.3 mile of fence. • Basin: a portion of allotment and primary range in the RWA along with 0.8 mile of fence. • Sweet Grass: a portion of allotment and primary range in the RWA. • S. Fork American: a major portion of allotment and primary range in the RWA along with 0.5 mile of fence and one water development. • Sunlight: the entire allotment and primary range in the RWA along with 0.3 mile of fence. • S. Fork of Shields: a major portion of allotment and primary range in the RWA along with 0.2 mile of fence. • Porcupine On/Off: a portion of allotment and primary range in the RWA along with 0.1 mile of fence. • Porcupine: a portion of allotment and primary range in the RWA. • Horse Creek: a portion of allotment and primary range in the RWA along with 0.6 mile of fence. • Little Cottonwood: a portion of allotment and primary range in the RWA. • Rock Creek: a major portion of allotment and primary range in the RWA. • Duck Creek: a portion of allotment and primary range in the RWA. • Little Timber: a portion of allotment and primary range in the RWA. • Swamp: a portion of allotment and primary range in the RWA. • Crazy: a portion of allotment and primary range in the RWA.
West Bridger RWA	Bridger, Bangtail, Crazy Mountains	Alternative D • Mill Creek: a major portion of the allotment and minor primary range with 0.2 mile of fence and one water developments. • Reese On/Off: a portion of the allotment and minor primary range with 0.2 mile of fence. • W Bridger: a portion of the allotment and minor primary range with 0.9 mile of fence.
Blacktail Peak RWA	Bridger, Bangtail, Crazy Mountains	Alternative D • Blacktail: a portion of primary range in the RWA along with 0.6 miles of fence and one water development.
Line Creek Plateau RWA Red Lodge Creek-Hell Roaring RWA Mystic RWA Republic RWA	Absaroka Beartooth Mountains	Alternatives B and C. • No allotments or infrastructure

Land Allocation	Geographic Area	Allotment Primary Range and Infrastructure
North Fk RWA Republic RWA Phelps Creek RWA W Woodbine RWA Mystic RWA Knowles Peak RWA Deckard Flats RWA	Absaroka Beartooth Mountains	Alternative D • No allotments or infrastructure
Line Creek Plateau RWA	Absaroka Beartooth Mountains	Alternative D • Rock Creek: a portion of allotment and primary range in the RWA
West Fork Rock Creek RWA	Absaroka Beartooth Mountains	Alternative D • Rock Creek: a portion of allotment and primary range in the RWA
Red Lodge Creek RWA	Absaroka Beartooth Mountains	Alternative D • Burnt Fork: a portion of allotment and primary range in the RWA. • Hogan Cr: portion of allotment and primary range in the RWA along with 0.8 mile of fence.
Dome Mountain RWA	Absaroka Beartooth Mountains	Alternative D • Slip and Slide: almost entire allotment and primary range in the RWA along with 6.8 miles fence and 5 water developments.
E. Rosebud to Stillwater RWA	Absaroka Beartooth Mountains	Alternative D • Fishtail: a portion of allotment and primary range in the RWA. • West Rosebud: a minor portion of allotment and primary range in the RWA. • East Rosebud: a minor portion of allotment and primary range in the RSW along with 0.5 mile of fence
Strawberry Creek RWA	Absaroka Beartooth Mountains	Alternative D • Elbow. A portion of allotment but no primary range in RWA, but includes 0.1 mile of fence and 0.2 mile pipeline
Mount Rae RWA	Absaroka Beartooth Mountains	Alternative D • Grouse Creek: a major portion of allotment and primary range in the RWA along with one water development. • Main Boulder: a portion of allotment and primary range in the RWA along with 0.6 mile fence • Contact: a portion of allotment and primary range in the RWA along with 0.8 mile fence
Tie Creek RWA	Absaroka Beartooth Mountains	Alternative D • Gaylor: a portion of allotment and primary range in the RWA along with 0.6 mile fence and one water development. • Mission Creek: a portion of allotment and primary range in the RWA along with 0.5-mile fence and two water developments. • Little Mission Creek: a portion of allotment and primary range in the RWA.

Land Allocation	Geographic Area	Allotment Primary Range and Infrastructure
Deer Creek RWA	Absaroka Beartooth Mountains	• Green Mountain: a portion of allotment and primary range in the RWA. • Dry Fork: a portion of allotment and primary range in the RWA. • Lodgepole: a portion of allotment and primary range in the RWA along with 1.3 miles fence and two water developments. • Pass Creek: a major portion of allotment and primary range in the RWA along with 1.9-mile fence and eight water developments. • Picket Pin: a portion of allotment and primary range in the RWA along with 0.9-mile fence and three water developments. • Bad Canyon: a portion of allotment and primary range in the RWA along with 3.7 miles fence and 11 water developments. • Blind Bridger: a minor portion of allotment and primary range. • West Bridger: a portion of allotment and primary range in the RWA along with 0.5-mile fence. • Deer Cr: a portion of allotment and primary range in the RWA along with 0.3 mile fence and three water developments. • W. Fork Deer Creek: a major portion of allotment and primary range in the RWA along with 1.3-mile fence and 12 water developments. • Evergreen: a portion of allotment and primary range in the RWA along with 0.4 mile fence and two water developments. • Lost Cabin Creek: a minor portion of allotment and primary range in the RWA. • Hubble: a portion of allotment and primary range in the RWA along with 1.3 mile fence and two water developments.
Sheep Creek RWA	Absaroka Beartooth Mountains	Alternative D • Lost Creek: a portion of allotment and primary range in the RWA. • Nurses Lake: a major portion of allotment and primary range in the RWA.
Emigrant Peak RWA	Absaroka Beartooth Mountains	Alternative D • Sixmile South: a portion of allotment and primary range in the RWA. • Sixmile North: almost entire allotment and primary range in the RWA along with 1.8 mile fence, 4 water developments, and 0.8 mile pipeline.
Chico Peak RWA	Absaroka Beartooth Mountains	Alternative D • Mill Creek: a minor portion of allotment and primary range in the RWA.
Sawtooth Mountains RWA	Madison, Henrys Lake, Gallatin	Alternative B • Horse Reeder Creek: a portion of the allotment and primary range along with 0.5 miles of fence are within the RWA • Tom Miner Ramshorn: A portion of the allotment and primary range within the RWA; 0.1-mile fence and one water development. • Lion Creek: a portion of the allotment and primary range within the RWA; no infrastructure. • Cottonwood: A portion of allotment and primary range within the RWA; no infrastructure.

Land Allocation	Geographic Area	Allotment Primary Range and Infrastructure
Gallatin RWA	Madison, Henrys Lake, Gallatin	Alternative C • Horse Reeder Creek: a major portion of the allotment and primary range are in the RWA along with 1.8 miles of fence and two water developments. • Lion Creek: the entire allotment and primary range within the RWA; no infrastructure. • Tom Miner Ramshorn: a portion of allotment and primary range in the RWA. • Cottonwood: a portion of allotment and primary range within the RWA; 0.9 mile of fence.
Gallatin RWA	Madison, Henrys Lake, Gallatin	Alternative D • Horse Reeder Creek: a major portion of allotment and primary range in the RWA along with 1.8-mile fence and two water developments. • Lion Creek: the entire allotment and primary range in the RWA. • Tom Miner Ramshorn: a portion of allotment and primary range in the RWA. • Cottonwood: a portion of allotment and primary range in the RWA along with 0.9-mile fence. • Bear Canyon: a portion of allotment and primary range in the RWA. • Big Bear: a portion of allotment but no primary range in the RWA. • Storm Castle: a portion of allotment and primary range in the RWA.
Cowboy Heaven RWA	Madison, Henrys Lake, Gallatin	Alternative C • Red Knob: a portion of the allotment and primary range within the RWA, along with 3.5 miles of fence. • Red Knob: a portion of the allotment and primary range within the RWA, along with 1.6 miles of fence.
Lionhead RWA	Madison, Henrys Lake, Gallatin	Alternative B • Sheep Mile: minor portion of allotment and minor amount of primary range. Alternative C • Sheep Mile: there are no allotments or infrastructure.
Lionhead RWA	Madison, Henrys Lake, Gallatin	Alternative D • Sheep Mile: a major portion of the allotment and primary range are in the RWA along with 0.6-mile fence. • Watkins Creek: a minor portion of the allotment and primary range are in the RWA
Cabin Creek North RWA	Madison, Henrys Lake, Gallatin	Alternative D • Sage Cr: a portion of the allotment and primary range are in the RWA along with 4.7 miles fence.
Taylor Hilgard RWA;	Madison, Henrys Lake, Gallatin	Alternatives B and C • No allotments or infrastructure
Taylor Hilgard RWA Spanish Peaks South RWA Spanish Peaks East RWA Cabin Creek South RWA	Madison, Henrys Lake, Gallatin	Alternative D • No allotments or infrastructure

Land Allocation	Geographic Area	Allotment Primary Range and Infrastructure
Buck Creek RWA	Madison, Henrys Lake, Gallatin	Alternative D • South Cinnamon: a major portion of allotment and primary range is in the RWA along with 2.5 miles fence and one water development. • North Cinnamon: a portion of allotment and primary range is in the RWA along with 0.5 miles fence.
Yankee Jim Lake RWA	Madison, Henrys Lake, Gallatin	Alternative D • Wigwam: a major portion of allotment and primary range is in the RWA along with 0.9-mile fence and one water development. • Green Lake: a major portion of allotment and primary range is in the RWA along with 5.8-mile fence and three water developments. • Section 22: Wigwam: the entire allotment and primary range is in the RWA along with two water developments.

Table 84. Allotment primary rangeland and infrastructure in backcountry areas (BCA)

Land Allocation	Geographic Area	Allotment Primary Range and Infrastructure
Chalk Buttes BCA	Sioux	Alternative D • Harkins: almost entire allotment and primary range in the BCA along with 3.5 mile of fence and two water developments. • N Trenk: entire allotment and primary range in the BCA along with 1.8 mile of fence and two water developments. • E Trenk: almost entire allotment and primary range in the BCA along with 1.8 mile of fence and three water developments. • W Trenk: almost entire allotment and primary range in the BCA along with 2.1 mile of fence and three water developments. • Kortum: a portion of the allotment and primary range in the BCA along with 2.7 mile of fence.
Tongue River Breaks BCA	Ashland	Alternatives B and C • W O'Dell: major portion of allotment and primary range in the BCA along with 11 water developments and 7 miles of fence.
King Mountain BCA	Ashland	Alternatives B and C • King Cr: Major portion of allotment and primary range in the BCA, along with 16 water developments and 19 miles of fence.
Cook Mountain BCA	Ashland	Alternatives B and C • Ash Cr: major portion of allotment and primary range in the BCA along with 17 water developments and 3 miles of fence.
Big Pryor BCA	Pryor Mountains	Alternative B • Crooked Cr: minor portion of allotment; no primary range within BCA. • Sage Cr. a portion of the allotment and minor primary range with 0.3 mile of fence. • Big Pryor: a portion of allotment and primary range with one water development and 0.3 mile of fence.

Land Allocation	Geographic Area	Allotment Primary Range and Infrastructure
Big Pryor BCA	Pryor Mountains	Alternative C • Crooked Cr: minor portion of allotment; no primary range within BCA. • Sage Cr. a portion of the allotment and minor primary range with 0.3 mile of fence and 10 water developments. • Big Pryor: a portion of allotment and primary range with 11 water development and 2.4 mile of fence.
Punchbowl BCA	Pryor Mountains	Alternative B • Dryhead: the entire allotment and primary range are within the BCA. • Wells: Minor allotment and primary range with <0.1 mile fence within BCA. • Sage Cr: minor portion of allotment and primary range within BCA • Crooked Cr: minor allotment and primary range within BCA
Punchbowl BCA	Pryor Mountains	Alternative C • Dryhead: the entire allotment and primary range are within the BCA. • Wells: Minor allotment and primary range with 0.8 mile fence within BCA. • Sage Creek: a minor portion of allotment and primary range within BCA. • Crooked Creek: minor allotment and primary range within BCA along with two water developments.
Bear Canyon BCA	Pryor Mountains	Alternative B • Bear Canyon: Major portion of allotment and primary range within BCA, along with 7 water developments and 2.5 miles of fence.
Bear Canyon BCA	Pryor Mountains	Alternative C • Bear Canyon: Major portion of allotment and primary range within BCA, along with 12 water developments and 2.5 miles of fence.
Bad Canyon BCA	Absaroka-Beartooth Mountains	Alternatives B and C • Bad Canyon majority of primary range; 22 water developments; 9 miles of fence. • Sheep Creek majority of primary range; 7 water developments; 1 mile of fence • Pass Creek some of primary range; 2 water developments; 1 mile of fence • Lodgepole minor primary range; no infrastructure

Land Allocation	Geographic Area	Allotment Primary Range and Infrastructure
Crazy Mountains BCA	Bridger, Bangtail, Crazy Mountains	Alternative C • Big Timber: a portion of allotment and primary range in the BCA along with 0.2 miles of fence. • Otter Creek: a portion of allotment and primary range in the BCA along with 0.3 miles of fence. • Basin: a portion of allotment and primary range in the BCA along with 0.8 miles of fence. • Sweet Grass: a portion of allotment and primary range. • S. Fork American: a major portion of allotment and primary range in the BCA along with 0.5 miles of fence and one water development. • Sunlight: the entire allotment and primary range in the BCA along with 0.3 miles of fence. • Shields River: a portion of allotment and primary range in the BCA. • Bennett Cr: a portion of allotment and primary range in the BCA. • S. Fork of Shields: a majority of allotment and primary range in the BCA along with 0.2 miles of fence. • Porcupine On/Off: a portion of allotment and primary range in the BCA along with 0.9 miles of fence and one water development. • Porcupine: a major portion of allotment and primary range in the BCA along with 0.9 miles of fence and one water development. • Horse Creek: a portion of allotment and primary range in the BCA along with 0.8 miles of fence and two water developments. • Little Cottonwood: a major portion of allotment and primary range in the BCA along with one water development. • Middle Fork Rock Creek: a major portion of allotment and primary range in the BCA along with one water development. • Rock Creek: a major portion of allotment and primary range in the BCA. • Duck Creek: a portion of allotment and primary range in the BCA. • Little Timber: a portion of allotment and primary range in the BCA. • Kid Royal: a portion of allotment and primary range in the BCA. • Swamp: a portion of allotment and primary range in the BCA. • Crazy: a portion of allotment and primary range in the BCA.
West Bridger BCA	Bridger, Bangtail, Crazy Mtns	Alternative C • Mill Creek: a major portion of allotment and primary range in the BCA along with 0.2 miles of fence and one water development. • Reese On/Off: a portion of allotment and primary range in the BCA along with 0.2 miles of fence. • W Bridger: the entire allotment and primary range in the BCA along with 0.9 miles of fence.
Blacktail Peak BCA	Bridger, Bangtail, Crazy Mtns	Alternative C • Blacktail: a portion of allotment and primary range in the BCA along with 0.6 miles of fence and one water development.

Land Allocation	Geographic Area	Allotment Primary Range and Infrastructure
Hyalite-Porcupine-Buffalo Horn BCA	Madison, Gallatin, Henrys	Alternative E • Horse Reeder Creek: a major portion of allotment and primary range is in the BCA along with 1.8 mile fence and two water developments. • Lion Creek: the entire allotment and primary range is in the BCA. • Tom Miner Ramshorn: a portion of allotment and primary range is in the BCA. • Cottonwood: a portion of allotment and primary range is in the BCA along with 0.9 mile fence.
West Pine BCA	Madison, Gallatin, Henrys	Alternative C • West Pine: entire allotment and primary range in BCA along with 0.6 mile fence and two water developments.
Cowboy Heaven BCA	Madison, Gallatin, Henrys	Alternatives B and C • Red Knob: Almost the entire allotment and primary range within the BCA, along with 7.6 miles of fence.
Lionhead BCA	Madison, Gallatin, Henrys	Alternative E • Sheep Mile: a major portion of the allotment and primary range are in the BCA along with 0.6 mile fence.
Buffalo Horn BCA	Madison, Gallatin, Henrys	Alternatives B and C • No allotments or infrastructure

Permittees that have allotments within portions of recommended wilderness and backcountry areas, could potentially have increased administrative requirements that make it more difficult to operate as compared to alternatives with less recommended wilderness and backcountry area allocation. Alternative D has the most recommended wilderness and/or backcountry area acreage and has the most potential to change motorized uses for grazing permit administration. Therefore, alternative D could affect the most grazing permittees in terms of allotment access, operability, and management. Alternative D would not lead to a decrease in permitted animal unit months, but could create increased operating expense for some affected permittees in terms of added time to manage their allotment(s). Alternatives B, C and E could also be potentially administratively restrictive for some permittees in recommended wilderness and/or backcountry areas, but less than alternative D. The current plans are least restrictive to allotment administration.

Many of the recommended wilderness and backcountry areas are also classified as inventoried roadless area where the setting is semi-remote/primitive, which would not result in substantial change in difficulty regarding travel or access as a result of these allocations, but would still result in a higher level of authorization scrutiny for motorized access for allotment administration purposes. However, many of these areas are outside of inventoried roadless areas as well. In these areas not classified as roadless, there would be potential to affect allotment operations for 12 permittees under alternative B, at least 32 permittees under alternative C, and at least 24 permittees under alternative D by being subject to increased review for authorizing administrative motorized travel.

Effects from Access Management

Travel planning has been completed on the Custer Gallatin National Forest, but travel plans are designed to adapt to changing conditions and adjust as needed in order to manage motorized use in accordance with other resource needs. The impact to livestock grazing from recreation and travel management is mainly limited by the grazing permit holder’s ability to use motor vehicles to access the allotment. Motorized vehicle access to areas allocated for nonmotorized settings can be authorized by line officers. These decisions are discretionary and are made on a case-by-case review of the proposal and circumstances. The intent of the nonmotorized areas is not to prevent allotment management as some of the motorized vehicle access needs include transportation of fence and/or water development materials, noxious weed control, and salt distribution. Under the revised plan alternatives, during particular times of the year, or with routes grown in with vegetation from the lack of use or maintenance, vehicle access may be more restrictive than what is available under the current plans.

Effects from Recreation Management

Recreation emphasis areas in all revised plan alternatives are areas that have existing high use by different types of recreationists. Locations are in the front country and accessible by roads. Recreation emphasis areas may have a high density of human activities and associated structures. There may be roads, utilities, and trails. Three of the six forest plan geographic areas have proposed recreation emphasis areas; none is proposed in the Pryor Mountains, Ashland or Sioux Geographic Areas. Higher levels of summer recreation could create increased levels of potential conflicts with livestock grazing, and often may complicate livestock management and make it more expensive (for example, more gates may be left open and livestock inadvertently or purposely moved). Increased traffic on roads and trails could make it more difficult to keep livestock in scheduled pastures as gates may be left open and cause livestock to stray. A management approach in the draft revised forest plan suggests educational messages to hunters on what to expect and how to interact with permittee activities on active allotments, such as closing gates and not shooting near livestock. With expected increases in visitation to easily accessible National Forest System lands, vehicle collisions with livestock on system roadways and vandalism to range improvement infrastructure are likely to increase. As displayed in table 85, plan components include recreation emphasis areas, which may have a high density of human activities and have the greatest potential for conflict with livestock operations under alternatives B, C and E and less so in alternative D.

Table 85. Allotments within recreation emphasis areas by alternative

Recreation Emphasis Areas	Geographic Area	Alternative B Allotments	Alternative C Allotments	Alternative D Allotments	Alternative E Allotments
Main Fork Rock Creek	Absaroka Beartooth	Rock Creek	Rock Creek	Rock Creek	Rock Creek
Main Boulder River	Absaroka Beartooth	Green Mountain, Hawley	Green Mountain, Hawley	Not Applicable	Green Mountain, Hawley
Yellowstone River Corridor	Absaroka Beartooth / Gallatin	Green Lake	Green Lake	Green Lake	Green Lake
Storm Castle	Madison, Henrys Lake, Gallatin	Not Applicable	Not Applicable	Not Applicable	Big Bear, Storm Castle
Gallatin River	Madison, Henrys Lake, Gallatin	Moose Creek, North Cinnamon, South Cinnamon, Sage Creek	Moose Creek, North Cinnamon, South Cinnamon, Sage Creek	Moose Creek, North Cinnamon, South Cinnamon, Sage Creek	Moose Creek, North Cinnamon, South Cinnamon, Sage Creek
Hebgen Lakeshore	Madison, Henrys Lake, Gallatin	Moose, Watkins Creek, and South Fork	Moose, Watkins Creek, and South Fork	Not Applicable	Moose, Watkins Creek, and South Fork
Number of Allotments	(not applicable)	11	11	6	11

Effects from Invasive Species Management

Noxious and other invasive weeds have the potential to substantially decrease livestock forage when left unchecked. Impacts are similar between all alternatives, including the current plans. Noxious weed management would continue under direction of both the Gallatin National Forest and the Custer National Forest noxious weed environmental impact statements (2005 and 2006, respectively), until revised. Any subsequent decisions based on environmental analysis would continue to provide additional direction. Infestation levels of invasive plants would likely remain steady to slightly increasing over time. Some species may contract in density as new treatment and biological options become available, while other weeds will expand in range and density.

All revised plan alternatives would formalize the need to adopt and authorize the best available tools for weed management, but the same tools can also be pursued under current management. Revised plan alternatives may be more favorable in the long term for overall management direction for invasive species, but in regards to effects on livestock forage, no significant difference would be present between the alternatives.

Current and foreseeable treatment objectives under alternatives A, B, and C for noxious weeds are adequate to maintain livestock forage production on grazing allotments. Alternative D treatment objectives would increase and lessen the loss of forage to competition from weeds. Alternative E treatment objectives would substantially decrease to one eighth to one quarter of the recent treatment levels, which would increase the chance of weeds outcompeting forage in some dense infested areas. As such, alternative E could result in early removal of livestock from a unit. Weed treatments and prioritization would need to continue to evolve in order to manage new weed species, expanding infestations, and possible herbicide resistance under all alternatives.

Minor inconveniences for grazing permit administration may occur under all alternatives for weed prevention and treatments. Access to areas may be temporarily closed or delayed for weed management activities. Also, mitigations, such as washing vehicles or equipment entering National Forest System lands, or restricting off-road travel may be used as part of the grazing permit and allotment plan. These actions may temporarily limit access but would have positive effects for rangeland vegetation and livestock forage under all alternatives.

Cumulative Effects

Adjacent Lands

Portions of the Custer Gallatin National Forest adjoin other national forests, each having its own forest plan. The Custer Gallatin National Forest is also intermixed with lands of other ownerships, including private lands, other Federal lands, and State lands. Some of the geographic areas are island ranges and are typically surrounded by private, State or Tribal lands.

Timber harvest, grazing, or conversion of rangeland or forests on adjacent lands would affect vegetation conditions at the landscape level, changing composition and structures, and could potentially affect the lands' capability to be grazed at current levels. Most National Forest rangelands, state (Montana and South Dakota) and BLM lands, should remain undeveloped and suitable for livestock grazing in the foreseeable future. Private lands surrounding the Custer Gallatin National Forest could potentially be affected by conversion to agricultural lands or residential development. Development of these private lands would affect wildlife connectivity and overall landscape function with National Forest System lands within the national forest. Future development of private lands adjacent to the national forest boundary could also affect the spread of invasive weeds, increase fire protection responsibilities and costs, as well as increasing the complexity of grazing livestock on the Custer Gallatin in some areas.

Some adjacent lands are subject to their own resource management plans. The national forest and grassland plans for National Forest System lands adjacent to the Custer Gallatin National Forest include the Helena Lewis and Clark, Beaverhead-Deerlodge, Shoshone, Bighorn, and Black Hills National Forests and the Dakota Prairie Grasslands. In general, management of vegetation is consistent across all national forests due to law, regulation, and policy. The cumulative effect would be that the management of vegetation and grazing would be complementary. This includes specific adjacent landscapes that cross national forest boundaries, such as the Henry Mountains, Bridgers, Crazy Mountains, and the Absaroka's. BLM lands near the Custer Gallatin National Forest are managed with BLM resource management plans by the Billings, Miles City, and Lewistown field offices. The Miles City and Billings resource management plans were recently revised in 2015 and Lewistown plans in 2014. These plans' components related to resilient terrestrial vegetation and livestock grazing are complementary to the plan components for the Custer Gallatin National Forest. Some Custer Gallatin National Forest grazing allotments contain

Montana State lands and would also need to follow resource management plan direction for those parcels. The Yellowstone National Park Foundation document 2014 calls for preserving natural vegetation, landscapes, and disturbance processes. Broadly, the terrestrial vegetation characteristics in this area are therefore likely similar to the wilderness areas in the adjacent Absaroka Beartooth and Madison, Gallatin, Henrys Geographic Areas and would complement these conditions. The Montana State Parks and Recreation Strategic Plan 2015-2020 guides the management of State parks, some of which lie nearby or adjacent to National Forest System lands. Terrestrial vegetation is a component of these parks, although not always the primary feature. Specific vegetation conditions would not necessarily contribute to the desired conditions as described for the Custer Gallatin National Forest. Montana's State Wildlife Action Plan describes a variety of vegetation conditions related to habitat for specific wildlife species. This plan would likely result in the preservation of these habitats on state lands, specifically wildlife management areas. These plans also outline the sideboards on how domestic grazing leases on wildlife management areas will be managed. This plan would complement grazing management on Custer Gallatin National Forest lands.

The Interagency Bison Management Plan is a cooperative, multi-agency effort that guides the management of bison and brucellosis in and around Yellowstone National Park, including livestock considerations. The plan was developed by the National Park Service, Forest Service, Animal and Plant Health Inspection Service, Montana Department of Livestock, and Montana Fish Wildlife & Parks. The Bison Plan has operated under an adaptive management framework since the record of decision was signed in 2000. Adjustments have been made to the framework numerous times. The Bison Plan partners created a formal adaptive management plan in December 2008 that incorporated changes made since the 2000 record of decision. Since then, the Interagency Bison Adaptive Management Plan has been considered a living document, updated annually or as appropriate. Revised forest plan components are consistent with the Interagency Bison Adaptive Management Plan.

Revised forest plan components are consistent with both the Sage-grouse Management Plan for South Dakota (2014-2018) and Montana Management Plan and Conservation Strategies for Sage-grouse (2005), which aim at achieving long-term sustained rangeland production that is beneficial to livestock production and maintenance of stage-steppe habitat for sage-grouse. Revised forest plan components are consistent with both the South Dakota Bighorn Sheep Management Plan (2018-2022) and Montana Bighorn Sheep Conservation Strategy (2010), which aim to minimize disease transmission between bighorn sheep and domestic sheep and goats. Separation of domestic sheep and goats from wild sheep populations is recognized as the most important step in maintaining healthy bighorn sheep populations and assessing new areas for potential reintroductions.

Livestock Grazing Use

Livestock grazing, especially for cattle, is likely to be still desired by the local livestock industry within the Custer Gallatin National Forest for the foreseeable future. Cattle, domestic bison, and horses that graze the Custer Gallatin during the summer months are provided forage largely from private lands during late fall, winter, and early spring. Forage from private lands during this period is in the form of native grass pasture, irrigated pasture, irrigated and dry land hay, and fall crop residue. The availability of private lands in the surrounding area that can provide summer forage is somewhat limited. This demand for forage, especially during the months June through October, is greater than National Forest System lands can supply. Productive lands associated with the lands surrounding the Custer Gallatin are generally used for crops, including spring/winter wheat and along with other cereal grains. Demand for grazing on

National Forest System lands should continue to be very high for livestock operators whose private lands are adjacent to the national forest.

Livestock management is generally considered more management intense on National Forest System lands than on private lands. Livestock grazing is influenced by effects that impact the allocation of forage resources between livestock and wildlife; predation and disease transmission; management adjustments to protect cultural and historical resources; fisheries; threatened and endangered species; water quality; considerations necessary due to wildland fire management, and recreation. All of these factors add to the complexity and expense for the ranching operations that are permitted to graze livestock on the national forest (Rimbey and Torell 2011). In addition, the business of livestock management is subject to factors most often not under the control of livestock operators, such as tourism; land values and potential subdivision of ranches; labor prices and availability; domestic and foreign demand for livestock products; markets and meat prices; fuel prices; social values; and Federal policy.

Increasing Human Population

It is expected that recreational uses on National Forest System lands will continue to increase as more people nationwide continue to look for places to recreate. As more people venture onto public lands, differing societal desires and ideas of what public lands should provide will continue to influence public land management policy. Increased attention and public recreation on grazing allotments in the future may make operating on National Forest System lands more expensive for permittees.

Conclusion

The objective of providing 219,306 animal unit months as currently permitted under term, term on/off - on provision, livestock use permits, and term private land permits (213,802) and as vacant allotment capacity would allow at some future point (5,504 animal unit months) would be the same under the current plans and alternatives B and C. The objective for alternative D would be to provide animal unit months as currently permitted at approximately 213,802 animal unit months and not the vacant allotment 5,504 animal unit months to account for the alternative D goal to potentially not reactivate vacant allotments for other resource purposes. The objective for alternative E would be to provide the currently permitted animal unit months (213,802) and the vacant allotments (5,504 animal unit months) may not be reactivated due to projected lower budgets for allotment and permit administration. Under all alternatives, the permitted use of the existing active grazing allotments would continue. However, these animal unit month levels may be modified as site-specific allotment changes are needed. Based on current rangeland and riparian conditions and the need to revise or review allotment management plans, changes in the amount of permitted animal unit months are difficult to predict. Project-level analysis and/or allotment-specific monitoring will determine site-specific prescriptions, future stocking rates and other management adjustments to meet desired conditions under all alternatives. Permitted animal unit months over the long-term could possibly decrease under all alternatives due to more intensive management of riparian areas and habitats for threatened, endangered, or at-risk species.

Desired conditions for livestock grazing emphasize sustainable grazing, stable soils, diverse vegetation and native plant communities, as well as riparian and wetland health. Movement toward these conditions would be achieved through implementation of the standards and guidelines for grazing and the other resource areas (see Terrestrial Vegetation section for projected effects to vegetation). Necessary changes to meet desired conditions would be implemented at the allotment management plan/project level. Grazing standards and guidelines generally would affect how allotment planning is implemented. The plan components developed for the revised forest plan are designed to protect upland, riparian, and wetland resources, manage noxious weeds, and maintain levels of forage within capacity of the land and in consideration of other resources.

With the incorporation of revised plan alternative components, livestock management in riparian areas may become more intensive under the revised plan alternatives than the current plans. Stubble height guidelines may place limitations on grazing, but would help provide for better vegetation and streambank conditions. Trailing livestock to other pastures would need to be done outside of riparian management zones. New permanent livestock handling facilities would need to be placed outside of riparian management zones.

Invasive weeds will continue to be one of the biggest threats to desired rangeland condition under all alternatives as these ecosystems are typically vulnerable to weed infestations. All alternatives have tools under the existing weed analysis decisions to effectively manage noxious weeds in a manner that should preserve forage production and permitted grazing use within allotments. The revised plan alternatives include plan components that are more proactive in adapting to new findings and technology in weed science and management, and should have a greater impact in slowing the spread of invasive species, which benefits herbaceous vegetation and, ultimately, livestock grazing in the future. However, the objectives for treatment under alternative E are substantially reduced to one eighth to one quarter of recent average treatments due to budget offsets that would go to other resources being emphasized under that alternative. As such, alternative E would not likely preserve forage production and other related habitat quality.

All alternatives have the opportunity to implement vegetation treatments, such as timber harvest, prescribed fire, and to allow wildfire to provide resource benefits where feasible. Vegetation should move towards a desired mix of conditions from these treatments and thus provide a secondary benefit of improving forage conditions and transitory range in the future.

All revised plan alternatives provide plan components for conflict resolution between livestock and grizzly bear, bison, bighorn sheep, greater sage-grouse, and other wildlife. Alternatives B, C, and D favor bison and alternative E favors livestock in case of conflicts. In consideration of reducing risk of disease transmission to bighorn sheep, alternatives A (current plans) and E allows for sheep or goat permit authorization in all geographic areas with appropriate site-specific risk of contact assessment. Under alternatives B and C, no sheep or goat permits would be authorized in the Madison/Gallatin/Henrys Lake, Absaroka-Beartooth or Pryor Mountain geographic areas, but permits could be authorized in the other geographic areas with an appropriate site-specific risk assessment. Under alternative D, sheep or goat permits would not be authorized forestwide.

Increased recreational uses of National Forest System lands within the Custer Gallatin would most likely make grazing on the national forest more expensive for permittees under any alternative due to potential vandalism to allotment infrastructure and gates being left open. Plan components include recreation emphasis areas, which may have a high density of human activities and has the most potential for conflict with livestock operations under alternatives B, C and E and less so in alternative D.

Motorized access for allotment administration is allowed to continue for maintenance of existing allotment infrastructure in allotments within recommended wilderness and backcountry areas, but administrative motorized use on new allotment infrastructure would be subject to increased review for use of motorized travel and equipment needed for maintenance. Land allocation and higher scrutiny for motorized access for allotment administration could affect cost and labor of allotment operations and infrastructure maintenance to permittees. Table 86 summarizes the number of permittees potentially affected by land allocations by alternative:

Table 86. Number of permittees potentially affected by land allocations by alternative

Land Allocation	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Wilderness Areas	9	9	9	9	9
Wilderness Study Area	7	7	7	7	7
Recommended Wilderness Areas	0	5	4	80	0
Backcountry Areas	0	19	44	21	5
Total	16	40	64	117	21

Permittees that have allotments within portions of recommended wilderness and/or backcountry areas, could potentially have increased administrative terms and conditions that make it more difficult to operate as compared to alternatives with less recommended wilderness and backcountry area allocation. Alternative D has the most recommended wilderness and backcountry area overlap with allotments and has the most potential to change motorized uses for grazing permit administration. Therefore, alternative D could affect the most grazing permittees (117) in terms of allotment access, operability and management. Alternative D would not lead to a decrease in permitted animal unit months, but could create increased labor and operating expense for some affected permittees in terms of added time to manage their allotment(s). Alternatives B, C and E could also be potentially administratively restrictive for 40, 64, and 20 permittees, respectively, in recommended wilderness or backcountry areas, but less than alternative D. The current plans are the least restrictive to allotment administration.

3.15 Timber

3.15.1 Introduction

The Custer Gallatin National Forest has a long history of supplying timber products for local uses. The harvest of trees from these forests provided wood materials for a variety of uses such as, fuelwood, sawlogs, house logs, posts and poles, and fencing materials. Timber harvest may be used to supply timber products as well as move vegetation towards desired conditions and meet other resource objectives such as improving watershed condition, improving wildlife habitat, and reducing wildfire risk. As such, a viable forest industry helps provide capacity to undertake forest restoration activities that require a trained workforce and mills to process resulting wood products (Smith et al. 2011). Timber harvest also provides jobs and income in logging and manufacturing of wood products. This section focuses on the effects of plan direction on timber suitability, timber supply, contribution of timber to economies, and timber harvest. The effects of timber harvest on ecological elements such as vegetation and wildlife are primarily assessed in other areas including the terrestrial vegetation and wildlife sections.

Regulatory Framework

Organic Administration Act of 1897: Forests are established "to improve and protect the Forest within the boundaries, or for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States."

Multiple-Use Sustained-Yield Act of 1960: "It is the policy of the Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed and wildlife, and fish purposes. The Secretary of Agriculture is authorized and directed to develop and administer the renewable surface resources of the national forests for multiple use and sustained yield of the several products and services obtained therefrom. . . 'Sustained yield of the several products and services' means the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of the various renewable resources of the national forests without impairment of the productivity of the land."

Forest and Rangeland Renewable Resources Planning Act of 1974, as amended by the National Forest Management Act of 1976: These acts set forth the requirements for land and resource management plans for national forests.

2012 Planning Rule (36 CFR 219): The procedures of the 2012 Planning Rule require the identification of areas suitable for timber production and of the amount of timber that can be removed annually on a sustained-yield basis. In addition, the procedures require an analysis of the supply and demand situation for resource commodities.

Forest Service Handbook 1909.12 chap. 60: This handbook describes the procedures for identification of lands as not suitable and suitable for timber production and methods for determining the sustained-yield limit, the projected wood sale quantity, and the projected timber sale quantity.

Key Indicators and Measures

- Timber Suitability (acres)
  - lands suitable for timber production
  - lands unsuitable for timber production where harvest may occur for purposes other than timber production
- Timber supply (million board feet, mmbf, and million cubic feet, mmcf)
  - projected timber sale quantity
  - projected wood sale quantity
  - sustained yield limit
- Timber harvest
  - Area harvested by decade (acres)

Methodology and Analysis Process

Timber production is defined as the growing, tending, harvesting, and regenerating of trees to produce logs or other products for industrial or consumer use. Lands determined to be suitable for timber production are areas identified as capable of producing a regular, periodic output of timber, maintained in perpetuity, without impairment of the productivity of the land or inconsistency with other land management direction. Criteria for determining timber suitability of lands are defined in the 2012 Planning Pule procedures at 36 CFR 219.11 and Forest Service Handbook 1909.12, chapter 60. The analysis for timber suitability was performed using existing GIS data to apply these criteria as detailed in appendix B.

Timber harvest outputs (projected volumes and treatment acres) were modeled using the linear optimization model, PRISM (Nguyen 2018). The assumptions and input data associated with model are detailed in appendix B and summarized here.

In the PRISM model, a mix of vegetation management activities are selected over time by considering the multiple resource objectives of each alternative coupled with land allocations, land suitability, budget limitations, and other resource limitations on treatments (such as plan components associated with riparian management zones or wildlife considerations). For each alternative, the PRISM model was run with a set of objectives and constraints that was in keeping with the theme of each alternative. The following summarizes key differences in PRISM model assumptions across alternatives:

- For all alternatives, the primary objective of harvest was to trend vegetation conditions towards the desired conditions.
- For all alternatives, the model was constrained by the minimum amount of saw timber volume to be produced based on objectives for each alternative (details below). The range of timber volumes was selected to reflect a reasonable range of outputs and vegetation management objectives and was based primarily on anticipated capacity given reasonably foreseeable budgets. Timber volumes were used as a minimum constraint; the model was able to schedule higher volumes if doing so would accelerate the rate of achieving the desired vegetation conditions.
- In a similar manner, the minimum number of acres to be treated (such as, by prescribed fire, timber harvest, or fuels treatments) was also used as a constraint based on the objectives and theme of the alternatives. The model was able to schedule treatments on more acres if doing so would accelerate the rate of achieving the desired vegetation conditions.
- For the current plans and alternatives B through D, the vegetation management budget was assumed to be comparable to fiscal years 2012 to 2015. For alternative E, the budget for vegetation management was assumed to increase by approximately 33 percent relative to current plans and alternatives B through D.
- All PRISM model runs assumed a non-declining flow in timber volume outputs. Models were projected 150 years to ensure long-term sustainability but only the first 50 years was analyzed.
- All alternatives assume a doubling in acres burned by wildfire per decade relative to the period from 1986 to 2015. Appendix B provides further information on the scientific basis for this assumption. Notably, a doubling of acres burned relative to this thirty-year time period represents only a modest increase from acres burned in the most recent decade for which data were available (2006 to 2016).

Harvest prescriptions are generalized for this broad scale analysis. During implementation of the forest plan under any alternative, site-specific prescriptions and silvicultural practices would be tailored to the forest stand to be treated. Further, site-specific mitigations and best management practices, such as those that apply in riparian management zones, would apply as described in the plan.

Although vegetation desired conditions are not quantified in the existing forest plans, in practice the Custer Gallatin National Forest would be managed in the spirit of these desired conditions under the current plans (for example, timber harvest would be used as a tool to achieve ecological integrity and resilience). As such, the desired conditions were used in the PRISM as the primary objective of timber harvest in all alternatives and the mix of treatments and volume estimates presented below reflect this management objective.

Information Sources

The affected environment was described using Forest Service cut and sold reports from the Timber Sale Accountability database and treatment records in the Forest Activity Tracking System database.

Vegetation plot data and a variety of geospatial data such as soil and vegetation mapping were used to determine the lands that may be suitable for timber production (appendix B). Yield tables were developed using forest inventory and analysis plot data in combination with the Forest Vegetation Simulator (Dixon 2008). This information was used in the PRISM model to estimate acres treated by treatment type and volume outputs associated with moving vegetation towards desired conditions, as described in appendix B. The actual timber harvest level that would occur during implementation of the plan is dependent on many variables, including budgets and the demand for products.

Analysis Area

The analysis area for timber suitability, timber supply, and timber harvest is comprised of the National Forest System lands administered by the Custer Gallatin National Forest. The temporal scope of the analysis is the anticipated life of the plan.

The analysis area for the contribution of timber to economies consists of a multi-county region depicted in the benefits to people, economic analysis area of influence. This area includes a total of 52 counties that stretch into five states. Within this economic area of influence exist all of the forest industry and wood products manufactures that historically have purchased timber sales and processed timber from the Custer Gallatin National Forest.

3.15.2 Affected Environment (Existing Condition)

Use and development of natural resources on the Custer Gallatin National Forest and surrounding lands played an essential role in the economy and growth of the area since the turn of the century. Mining for gold and other minerals boomed in the late 1800s, and associated tree cutting on both national forests occurred for fuelwood, mine timbers, and railways was extensive. During the time period of approximately 1920-1950, timber harvest took place on the Sioux and Ashland Districts of the Custer National Forest primarily to supply railroad ties for the building of railroads and a considerable number of accessible drainages and draws contained a small saw mill.

In addition to information below, see the Final Timber Assessment Report (Thornburgh 2017) for more detail on the affected environment relative to timber production and harvest.

Timber Suitability

The 1986 Custer Forest Plan estimates that 239,231 acres or about 20 percent of the total forest acres as tentatively suitable for timber production, and the Gallatin Forest Plan estimates that approximately 440,000 acres or about 23 percent of the total forest acres as tentatively suitable for timber production.

Suitable lands recorded in the current database for the combined Custer Gallatin National Forest show approximately 680,708 acres as may be suitable for timber production (table 87).

Table 87. Summary of lands that may be suitable for timber production under current plans

Land Classification Category	Acres
A. Total National Forest lands in the plan area	3,039,269
B. Lands not suited for timber production due to legal or technical reasons	2,358,561
C. Lands that may be suited for timber production (A−B)	680,708
D. Total lands suited for timber production because timber production is compatible with the desired conditions and objectives established by the plan	665,247
E. Lands not suited for timber production because timber production is not compatible with the desired conditions and objectives established by the plan (C – D)	15,461
F. Total lands not suited for timber production (B+E)	2,374,022

A total of 665,247 acres or approximately 22 percent of the forested acres are suitable for timber production under the current forest plans (table 88). The approximately 15,000 acres difference between may be suitable designations is primarily due to the removal lands designated as Eligible Wild and Scenic Rivers and Special Interest Areas.

Table 88. Summary of lands currently suitable of for timber production

Geographic Area	Total NFS acres	Suitable Acres	% of Geographic Area
Sioux	164,460	65,958	40%
Ashland	436,124	196,123	45%
Pryor Mountains	75,067	32,888	44%
Absaroka Beartooth Mountains	1,353,295	96,744	7%
Bridger, Bangtail, Crazy Mountains	205,025	59,027	29%
Madison, Henrys Lake, Gallatin Mountains	805,299	214,504	27%
Custer Gallatin National Forest	3,039,269	665,247	22%

Timber Supply

Forest growth rates directly influence potential timber production over time. Site productivity is generally considered to be fixed based upon site attributes such as topography, soil type, and climate. On the Custer Gallatin National Forest, based on current Forest plans, site productivity in terms of tree growth is estimated to be between 20 and 119 cubic feet per acre per year on suitable lands with average rotation ages ranging from 90 to 120 years, depending on the species and site.

The current 1986 Custer Forest Plan estimated the long-term sustained yield capacity (LTSYC) to be 6.4 million board feet (MMBF) per average annual year and the Gallatin Forest Plan estimated the long-term sustained yield capacity to be 27.0 MMBF per average annual year. Current long-term sustained yield capacity is based on the assumption that suitable timber lands are maximized for timber production.

The Periodic Timber Sale Accomplishment Reports (PTSAR) provide summaries of the timber products sold each year since 1980, in thousand board feet (MBF). Figure 54 displays the total volume of timber products sold on each national forest from 1980 to 2015. "Timber products" include sawtimber, pulp, poles, posts, and nonsaw material. The largest combined volumes sold occurred in 1980 at over 30 million board feet. Beginning in the early 1990s, combined volume sold began a general downward trend, with pulses ranging from less than 1 MMBF to approximately 19 MMBF per year. Volume from the Gallatin National Forest has sharply declined from the 1980s and volume from the Custer National Forest has remained relatively stable with periods of no volume sold followed by periods of volume exceeding the yearly allowable sale quantity throughout the forest plan period.

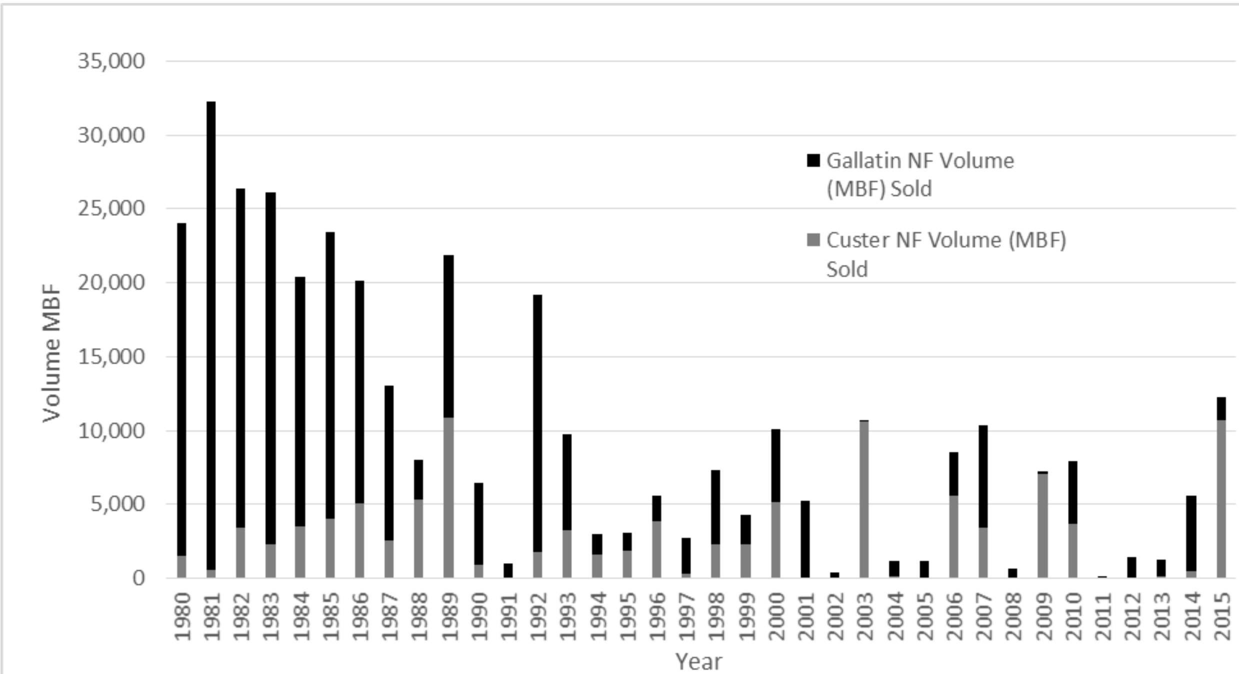

Figure 54. Total volume sold by national forest, 1987-2015 (excluding fuelwood)

Sawtimber encompasses the major portion of volume over the span of the current forest plan. Starting in 2004, nonsaw material became a component of wood products sold on the Custer Gallatin National Forest. Much of the nonsaw materials sold on both national forests is made up of fire-killed trees from wildfires and mountain pine beetle-killed trees. Post and pole materials have been a small and minor component of volume sold on the national forests. Sales of post and pole materials have gone down since the early 1980s and is currently a very small component of volume sold on the Custer Gallatin National Forest.

Figure 55 displays the proportional sawtimber volume sold by tree species on the Custer Gallatin National Forest between 1980 and 2015. The primary species utilized for sawtimber on the Custer Gallatin National Forest is lodgepole pine (36 percent). For multiple reporting years a significant amount of volume was categorized as "combined softwood"; this is a combination of Engelmann spruce, subalpine fir, or any combination of the tree species displayed in figure 55. Lodgepole pine and ponderosa pine combined accounted for about 62 percent of the volume sold and are valuable for manufacturing a variety of wood products that consumers use. Douglas-fir is the third most prevalent sawtimber species sold (10 percent).

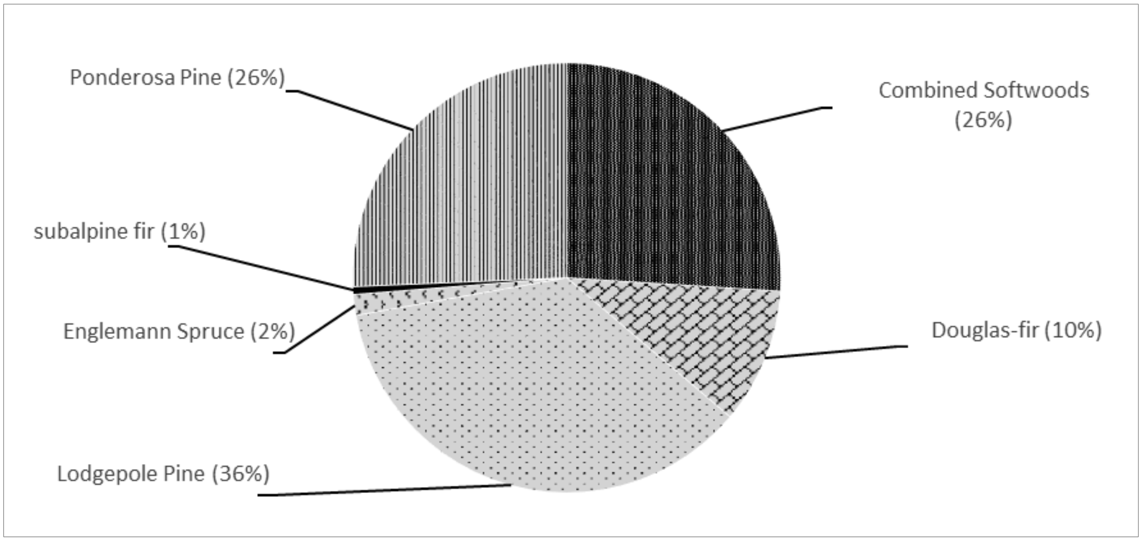

Figure 55. Sawtimber volume sold 1980-2015 by species on the Custer Gallatin National Forest

This mix of saw timber eventually supplies a number of manufacturing firms located within a limited range of the Custer Gallatin National Forest. Timber harvest contributes to a small, but historic, economic sector in this part of Montana. For more information on the contributions of timber harvests to the economy, see section General Contributions to Society and Economic Sustainability.

Timber Harvest

Timber harvest is a tool used not only to provide timber products and contribute to the local economy, but also to achieve multiple resource objectives. These include reducing insect or disease impacts, improving wildlife habitat, increasing tree growth, improving timber productivity, lowering fuels and fire risk, and altering vegetation conditions to enhance forest resilience. Three main types of timber harvest are displayed: even-aged regeneration harvest (such as clearcutting, shelterwood, and seed-tree cuts); uneven-aged regeneration harvest (such as group selection and single-tree selection); and intermediate harvest (such as commercial thins and improvement cutting). Table 89 displays the harvest activities by harvest type and geographic location from the 1940s to 2015. Harvest activities have occurred on approximately 7 percent of the non-wilderness land base on the Custer Gallatin National Forest.

Table 89. Custer Gallatin National Forest harvest acres by harvest type and geographic location since 1940

Geographic Area	Regeneration Harvest	Uneven-aged Harvest	Intermediate Harvest	Total Harvest Acres
Sioux	4,932	2,515	9,556	17,003
Ashland	1,978	2,465	6,035	10,478
Pryor Mountains	625	0	276	901
Absaroka Beartooth Mountains	8,905	477	4,409	13,791
Bridger, Bangtail, Crazy Mountains	20,483	1,372	2,846	24,701
Madison, Henrys Lake, Gallatin Mountains	60,212	6,666	20,950	87,828
Total	97,329	13,495	44,679	155,503

Table 90 displays the trend of harvest type by decade across the Custer Gallatin National Forest. The greatest amount of harvest occurred in the 1960s and 1980s; over 37,000 acres were harvested in each of these periods. Regeneration harvests were the most common, representing over 65 percent of harvest type prior to 2010. There has been a shift proportionately to more intermediate harvests recently, trending toward 40 percent in the 1980s and 1990s, and 70 percent since the 2000s. Regeneration harvests, removing dead trees, since 2000 have been largely related to post-fire and insect salvage. Total harvest acres have declined sharply since the 1990s.

Table 90. Harvest acres by type and decade for the Custer Gallatin National Forest (1940-2015)

Year Decade	Acres of Regeneration Harvest	Acres of Uneven-aged Harvest	Acres of Intermediate Harvest	Totals
1940-1949	193	1,260	0	1,453
1950-1959	7,327	3,041	265	10,633
1960-1969	31,490	1,973	3,856	37,319
1970-1979	18,328	3,396	3,065	24,789
1980-1989	19,787	2,714	14,888	37,389
1990-1999	16,554	665	12,165	29,384
2000-2009	3,650	212	5,794	9,656
2010-2015	0	234	4,646	4,880
Totals	97,329	13,495	44,679	155,053

Economic conditions and changing timber market values are partially responsible for the lows and highs in timber harvest levels; insect and disease epidemics and wildfires are ecological factors that also influence harvest levels and trends. Salvage of fire-killed trees on the Custer Gallatin National Forest following stand-replacement fires in the late 1980s and early 2000s increased the regeneration harvest levels during that time.

3.15.3 Environmental Consequences

Current Plans

Management Direction under the Current Plans

The current forest plans provide extensive direction on timber management under the current plans. Plan direction ensures that timber harvest is conducted within law and policy and is sustainable over time. Plan direction includes limitations on timber harvest required by law, primarily the National Forest Management Act, such as assurance of restocking. Under the current plans, even-aged harvest is limited to a 40-acre maximum opening.

Custer Forest Plan goals and objectives for timberland management are to harvest timber within the sustained-yield capability to help: maintain timber dependent communities, maintain forest health, vigor and productivity, provide vegetative diversity for wildlife, eliminate tree encroachment on selected livestock grazing areas, salvage dead timber, control insects and disease, reduce natural fuel loading, and provide for scenic openings. The plan regulates timber harvest activities such as silviculture systems, timber stand improvement and reforestation, and opening size.

Gallatin Forest Plan goals and objectives for timberland management are to: provide a sustained yield of timber products and improve the productivity of timber growing lands, salvage dead timber, harvest in areas with insects, distribute vegetation management activities over the entire suitable timber base, and experiment with new techniques in certain areas. The plan regulates timber harvest activities such as silviculture systems, site preparation and debris disposal, tree improvement and regeneration, opening size, and number of snags.

Timber harvest plan direction under the current plans are not designed to move the Custer Gallatin National Forest towards desired vegetation conditions. However, in practice, the current plans are being implemented to achieve desired conditions.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

Similar to the current plans, the revised plan alternatives provide extensive direction to ensure timber management complies with law and policy and is sustainable over time.

All revised plan alternatives contain the same plan components for timber and other forest products. Plan components in all alternatives are consistent with the 2012 Planning Rule and the National Forest Management Act. All alternatives include provisions for sustainable levels of forest products, assurance of restocking, direction on where harvest for purposes of timber production may occur, where harvest should not occur due to resource concerns (soil, riparian areas, wildlife, etc.), and requirements for even-aged harvest including maximum opening size. Vegetation desired conditions provide a framework to guide the design and objectives of harvest activities. Plan components related to suitability of designated areas as well as standards and guidelines related to particular resources areas, such as recreation, wildlife, or scenic integrity, will affect design of harvest activities. The revised plan alternatives specify an exception to the 40-acre maximum opening size created by even-aged harvest.

All Alternatives

Timber Suitability

Lands suitable for timber production were determined following the 2012 Planning Rule (U.S. Department of Agriculture 2012a) and associated directives (USDA 2015c). Lands that may be suitable for timber production are the same for all alternatives and total 680,708 acres (table 91). These lands are physically and biologically capable of timber production and have not been administratively withdrawn.

Based on management guidance and desired conditions, the lands suitable for timber production vary by alternative, as shown in table 91 and table 92. Timber suitability for the current plans are based on the 1986 and 1987 forest plans as amended and implemented. The total land area considered suitable for timber management under the current plans is roughly 22 percent of the Custer Gallatin National Forest. Alternatives B through E have similar amounts of land suitable for timber production ranging from approximately 18-20 percent of National Forest lands. The primary reason for the difference between the current plans and the revised plan alternatives is the removal of lands in riparian management zones from the suitable timber base in all revised plan alternatives. Otherwise, at the forestwide scale, there is relatively little variability in suitable acres among alternatives. This is because of primary factors driving suitability at the forestwide scale, such as the inherent capability of the land and existing designations such as wilderness and inventoried roadless areas, do not vary by alternative.

Table 91. Lands not suitable for timber production by alternative

Land Classification Category	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
A. Total National Forest lands in the plan area	3,039,269	3,039,269	3,039,269	3,039,269	3,039,269
B. Lands not suited for timber production due to legal or technical reasons	2,358,561	2,358,561	2,358,561	2,358,561	2,358,561
C. Lands that may be suited for timber production (A−B)	680,708	680,708	680,708	680,708	680,708
D. Total lands suited for timber production because timber production is compatible with the desired conditions and objectives established by the plan	665,247	582,338	570,146	553,950	604,502
E. Lands not suited for timber production because timber production is not compatible with the desired conditions and objectives established by the plan (C – D)	15,461	98,372	110,564	126,758	76,206
F. Total lands not suited for timber production (B+E)	2,374,022	2,456,933	2,469,125	2,485,319	2,434,767

Table 92 displays the lands suitable for timber production by alternative in each geographic area and forestwide. Again, there is relatively little variability among the revised plan alternatives with the exception of the Pryor Mountains, where inclusion of backcountry areas in alternatives B and C, and recommended wilderness in alternative D notably lower the amount of suitable timber ground relative to alternative E in this geographic area.

Table 92. Acres and percent of National Forest System (NFS) land suitable for timber production by geographic area and alternative

Geographic Area	Total NFS acres	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
Sioux	164,460	65,958 (40%)	59,859 (36%)	59,859 (36%)	57,519 (35%)	59,859 (36%)
Ashland	436,124	196,123 (45%)	189,379 (43%)	189,379 (43%)	189,384 (43%)	189,529 (43%)
Pryor Mountains	75,067	32,888 (44%)	13,240 (18%)	13,240 (18%)	11,931 (16%)	28,635 (38%)
Absaroka Beartooth Mountains	1,353,295	96,744 (7%)	79,817 (6%)	79,817 (6%)	71, 241 (5%)	85,737 (6%)
Bridger, Bangtail, Crazy Mountains	205,025	59,027 (29%)	51,806 (25%)	44,118 (22%)	50,963 (25%)	51,806 (25%)
Madison, Henrys Lake, Gallatin Mountains	805,299	214,504 (27%)	188,237 (23%)	183,732 (23%)	172,911 (21%)	188,937 (23%)
Custer Gallatin National Forest	3,039,269	665,247 (22%)	582,018 (19%)	569,826 (19%)	553,950 (18%)	604,502 (20%)

On lands not suitable for timber production, but where timber harvest is allowed, timber harvest contributes to achieving desired conditions while providing economic and social services and benefits to people. Timber harvest on these lands occurs for purposes such as salvage, fuels management, insect and disease mitigation, protection or enhancement of wildlife habitat, research or administrative studies, or recreation and scenic-resource management. Timber harvest would have to be consistent with other management direction. Any timber harvest from these lands is not scheduled and would not occur on a rotation basis. Table 93 compares the proportion of lands where harvest may occur. In the current plans, lands unsuitable for timber production, where harvest is allowed, represent roughly 17 percent of the Custer Gallatin National Forest; although harvest may be very limited in some of these areas depending on management direction and objectives, as well as existing vegetation conditions. Among the revised plan alternatives, alternative D has substantially less land that would be available for timber harvest, primarily due to the amount of recommended wilderness in this alternative. It is important to note, in all alternatives the main component of lands that are available for harvest, but not suitable for production fall in inventoried roadless areas where only very limited harvest could occur (per the 2001 Roadless Area Conservation Rule). Limitations associated with inventoried roadless areas are the same across all alternatives.

Table 93. Proportion of lands that are available for timber harvest

Availability for Timber Harvest	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Not Available[1]	61%	61%	63%	74%	60%
Available	17%	19%	19%	8%	20%
Suitable	22%	19%	19%	18%	20%

1. Proportion of National Forest System lands unsuitable for timber production and where harvest may not occur. Includes non-forest lands and lands where timber harvest would not be permitted for any purpose, such as designated wilderness, wilderness study areas and recommended wilderness.

Timber Supply

Due to regulatory changes on the landscape, including changes to the areas that may be suitable for timber production, the timber supply estimates in the 1986 plans no longer reflect the management situation in the future if the current plans were selected. For this reason, and to make direct comparisons to the revised plan alternatives, the projected volumes in the 1986 forest plans were updated to display projected volumes following current handbook requirements. Plan objectives for the current plans are based on recent budgets and associated accomplishments.

To clearly display the intended timber program associated with achieving ecological, social, and economic desired conditions, the plan identifies the projected wood sale quantity and projected timber sale quantity. The projected wood sale quantity (PWSQ) is the estimated output of timber and all other wood products (such as fuelwood, firewood, or biomass) expected to be sold during the planning period for any purpose (except salvage harvest or sanitation harvest) on all lands on the Custer Gallatin. The projected timber sale quantity (PTSQ) is the portion of the projected wood sale quantity that meets applicable utilization standards (the sawlog portion of offered timber sales). As required by the Planning Rule and handbook direction, the projected timber sale quantity and projected wood sale quantity reflect currently foreseeable budget levels. The sale quantities are also estimated without a budget constraint to assess sustainable volumes under potentially higher budgets.

Projected timber and wood sale quantities were estimated using the PRISM model based on reasonably foreseeable budget levels, as shown in table 94. The model was run with a mix of constraints based on the theme of the alternative as described above. Objectives for the current plans and alternatives B and

C were to achieve a projected timber sale quantity of 10 mmbf (million board feet) year while alternatives D and E were set at 6 mmbf and 15 mmbf respectively.

Table 94. Average annual projected timber and wood sale quantities assuming reasonable foreseeable budgets

Category	Decade	Alt A	Alt B /C	Alt D	Alt E
Timber Products[1] **A1.** Lands suitable for timber production	1	1.77 mmcf 9.5 mmbf	1.80 mmcf 9.5 mmbf	1.14 mmcf 5.70 mmbf	2.76 mmcf 14.25 mmbf
	2	1.84 mmcf 9.5 mmbf	1.82 mmcf 9.5 mmbf	1.14 mmcf 5.70 mmbf	2.80 mmcf 14.25 mmbf
Timber Products[1] **A2.** Lands not suitable for timber production	1	mmcf 0.5 mmbf	0.10 mmcf 0.5 mmbf	0.06 mmcf 0.3 mmbf	0.15 mmcf 0.75 mmbf
	2	mmcf 0.5 mmbf	0.10 mmcf 0.5 mmbf	0.06 mmcf 0.3 mmbf	0.16 mmcf 0.75 mmbf
Projected Timber Sale Quantity[1] (PTSQ, **A1 + A2**)	1	1.88 mmcf 10.0 mmbf	1.90 mmcf 10.0 mmbf	1.21 mmcf 6.0 mmbf	2.90 mmcf 15.0 mmbf
	2	1.93 mmcf 10.0 mmbf	1.92 mmcf 10.0 mmbf	1.2 mmcf 6.0 mmbf	2.96 mmcf 15 mmbf
Other Wood Products[2] **B.** All lands	1	2.05 mmcf 8.0 mmbf	2.05 mmcf 8.0 mmbf	1.74 mmcf 6.80 mmbf	2.44 mmcf 9.5 mmbf
	2	2.05 mmcf 8.0 mmbf	2.05 mmcf 8.0 mmbf	1.74 mmcf 6.80 mmbf	2.44 mmcf 9.5 mmbf
Projected Wood Sale Quantity[3] (PWSQ) – (**A1+A2+B**)	1	3.93 mmcf 18.0 mmbf	3.95 mmcf 18.0 mmbf	2.95 mmcf 12.8 mmbf	5.34 mmcf 24.5 mmbf
	2	3.99 mmcf 18.0 mmbf	3.97 mmcf 18.0 mmbf	2.94 mmcf 12.80 mmbf	5.4 mmcf 24.5 mmbf

1. Timber Products and Projected timber sale quantity (PTSQ) include volumes from harvested material (other than salvage or sanitation) that meet timber product utilization standards
2. Other Wood Products - Fuelwood, biomass, and other volumes that do not meet timber product utilization standards (small diameter 3-7 inches)
3. Projected wood sale quantity (PWSQ) is the average annual estimated quantity of timber and other wood products that is expected to be sold from the plan area for the plan period. It consists of the PTSQ plus other material such as fuelwood, firewood, or biomass that is also expected to be available for sale.
4. mmbf- million board feet and mmcf- million cubic feet

To achieve 15 mmbf in alternative E, it was necessary to assume that the budget for vegetation management would increase relative to the current plans and alternatives B-D. This would have effects on other resource areas as displayed in the comparison of alternatives in table 2. The projected wood sale quantity for each alternative ranges from approximately 13 to 24.5 mmbf reflecting theprojected timber sale quantity of that alternative plus additional volume from fuelwood (estimated as 5 mmbf in all alternatives), as well as volume from non-saw material (estimated as approximately 30 percent of projected timber sale quantity). All alternatives were modeled with the objective of moving vegetation towards desired conditions while meeting other resource constraints. Outputs are expressed as average annual outputs (averaged across the decade). The model assumed 95 percent of the volume to be removed from lands suitable for timber production. Alternative E has the highest objective for timber output.

The PRISM model was also run without a budget limitation, as shown in Table 95. The objective for all models ran was to move vegetation towards desired conditions. Because all resource constraints are considered, these outputs levels represent what could be generated given the ecological conditions of the Custer Gallatin National Forest, coupled with regulatory direction and the management emphasis of each alternative. These numbers are not used as objectives in the revised plan because they do not meet the requirement to be within reasonably foreseeable budgets. The budget constraint was the most influential factor affecting projected volume outputs. However, even without a budget constraint, volume outputs is limited by resource constraints associated with each alternative as well as the assumption of a non-declining flow in timber volumes. As shown in table 95, all alternatives produced approximately the same volume in the unconstrained model runs suggesting that the requirement of non-declining flow becomes the primary limiting factor after budget constraints.

Table 95. Average annual projected timber and wood sale quantities without a budget constraint

Category	Decade	Alt A	Alt B	Alt C	Alt D	Alt E
Timber Products[1] **A1.** Lands suitable for timber production	1	4.15 mmcf 21.08 mmbf	3.68 mmcf 18.77 mmbf	3.58 mmcf 18.25 mmbf	4.16 mmcf 20.49 mmbf	3.75 mmcf 19.13 mmbf
	2	4.13 mmcf 21.08 mmbf	3.79 mmcf 19.29 mmbf	3.72 mmcf 18.93 mmbf	4.09 mmcf 20.49 mmbf	3.88 mmcf 19.77 mmbf
Timber Products[1] **A2.** Lands not suitable for timber production	1	0.23 mmcf 1.11 mmbf	0.32 mmcf 1.54 mmbf	0.35 mmcf 1.68 mmbf	0.22 mmcf 1.08 mmbf	0.35 mmcf 1.69 mmbf
	2	0.22 mmcf 1.11 mmbf	0.20 mmcf 1.02 mmbf	0.20 mmcf 1.00 mmbf	0.21 mmcf 1.08 mmbf	0.21 mmcf 1.04 mmbf
Projected Timber Sale Quantity[1] (PTSQ, **A1 + A2**)	1	4.38 mmcf 22.19 mmbf	4.00 mmcf 20.31 mmbf	3.93 mmcf 19.93 mmbf	4.38 mmcf 21.57 mmbf	4.10 mmcf 20.81 mmbf
	2	4.36 mmcf 22.19 mmbf	3.99 mmcf 20.31 mmbf	3.92 mmcf 19.93 mmbf	4.30 mmcf 21.57 mmbf	4.09 mmcf 20.81 mmbf
Other Wood Products[2] **B.** All lands	1	2.99 mmcf 11.66 mmbf	2.84 mmcf 11.09 mmbf	2.81 mmcf 10.98 mmbf	2.94 mmcf 11.47 mmbf	2.88 mmcf 11.24 mmbf
	2	2.99 mmcf 11.66 mmbf	2.84 mmcf 11.09 mmbf	2.81 mmcf 10.98 mmbf	2.94 mmcf 11.47 mmbf	2.88 mmcf 11.24 mmbf
Projected Wood Sale Quantity[3] (PWSQ) – (**A1+A2+B**)	1	7.37 mmcf 33.85 mmbf	6.84 mmcf 31.40 mmbf	6.74 mmcf 30.91 mmbf	7.32 mmcf 33.04 mmbf	6.98 mmcf 32.06 mmbf
	2	7.35 mmcf 33.85 mmbf	6.83 mmcf 31.40 mmbf	6.73 mmcf 30.91 mmbf	7.24 mmcf 33.04 mmbf	6.97 mmcf 32.06 mmbf

1. mmbf- million board feet and mmcf- million cubic feet

Sustained-yield Limit

A sustained-yield limit was calculated to determine the amount of timber "which can be removed from [a] forest annually in perpetuity on a sustained-yield basis" (National Forest Management Act, sec. 11, 16 U.S.C. 1611; 36 CFR 219.11(d)(6)). Based on Forest Service handbook direction (Forest Service Handbook 1909.12, 64.3), the sustained-yield limit is the volume that could be produced in perpetuity on lands that may be suitable for timber production. The calculation of the sustained-yield limit is not limited by land management plan desired conditions, other plan components, or the Custer Gallatin's fiscal capability and organizational capacity. The sustained-yield limit is not a target; it is a limitation on harvest. Because it is based on lands that may be suitable for timber production, the sustained-yield limit does not vary by alternative. The sustained-yield limit was calculated using the PRISM model for each proclaimed forest separately and was determined to be 3.16 million cubic feet (15.3 million broad feet) annually on the

Custer National Forest and be 4.92 million cubic feet (22.95 million broad feet) annually on the Gallatin National Forest.

Table 96 displays the projected acres of vegetation management that may occur to achieve the objectives shown in table 9 with a reasonably foreseeable budget. Acres treated are a mix of silvicultural prescriptions, including even-aged regeneration (clearcut, seedtree, shelterwood), intermediate harvest (uneven-aged harvest or commercial thin), non-commercial treatments (such as, precommercial thinning and fuels treatments) and prescribed fire. The harvest levels achieved during the implementation of the 1986 plans to date is shown in the affected environment section. The PRISM model was used to estimate the mix of treatments that would occur under all alternatives in the future as explained above (also see appendix B).

Table 96. Projected acres of forested vegetation treatments, average of the first two decades

Activity	Alt A	Alt B	Alt C	Alt D	Alt E
Even-aged Regeneration Harvest	3,678	3,336	3,301	828	5,441
Intermediate Harvest	6,176	6,435	6,476	7,792	5,414
Other Mechanical Treatments (such as, precommercial thinning and fuels treatments)	20,166	20,210	19,776	32,911	7,200
Prescribed Fire	29,980	30,020	30,448	38,469	32,050
Total Acres Treated	60,000	60,000	60,000	80,000	50,105

In addition to the total number of acres harvested, it is also useful to compare the distribution of timber harvest across vegetation types by alternative. Figure 56 shows the relative distribution of timber harvest acres across the Northern Region Broad Potential Vegetation Types (PVT) by alternative, averaged over the first five decades. Across all alternatives, the model scheduled most of the harvest acres in the Warm Dry Pine Savanna PVT. This reflects the ecological departure of this frequent fire system resulting in an emphasis for restoration efforts as well as the relatively large amount of suitable base in this area (approximately 42 percent of total suitable base).

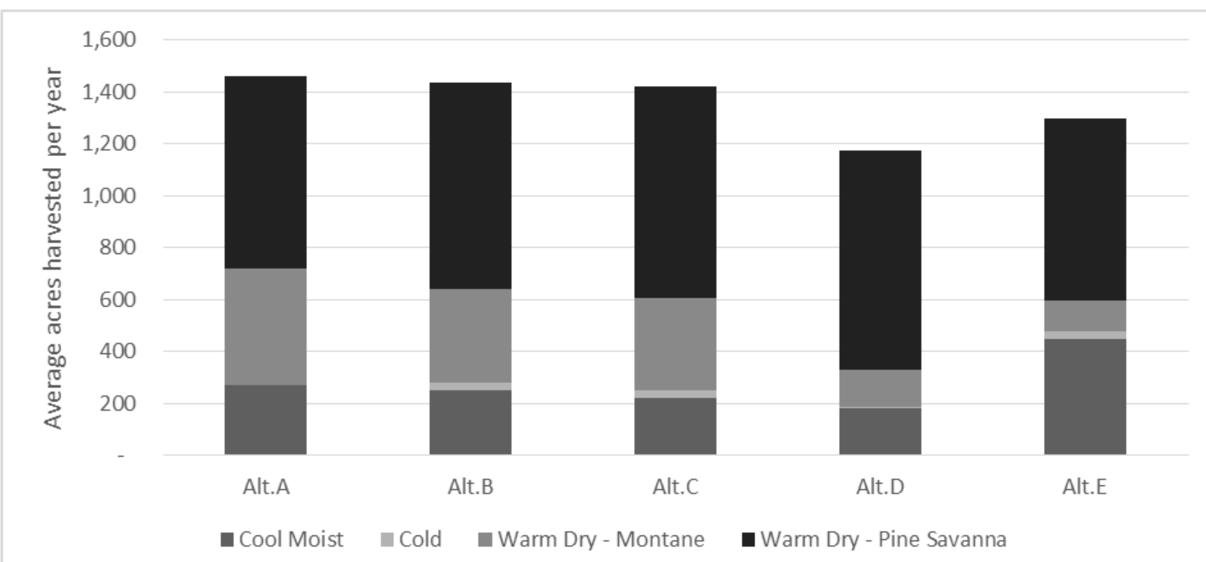

Figure 56. The average of acres harvested per year by Northern Region Broad Potential Vegetation Types

Consequences to Timber from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Land Allocations

Plan components related to management of land allocations such as backcountry areas, recreation emphasis areas, recommended wilderness areas, and special areas can affect timber harvest by requiring specific design criteria and considerations for harvest operations or by restricting availability of lands to harvest. The effects of these plan components were considered in both the suitability analysis as well as the PRISM modeling and consequences are reflected in projected outputs presented above. See table 9 for a summary of which land allocations limit timber harvest and/or suitability and how this varies by alternative.

Effects from Terrestrial Vegetation Management

The revised plan alternatives contain detailed desired conditions and objectives for terrestrial vegetation; timber harvest is one of the tools available to help move the Custer Gallatin toward those conditions. Although vegetation desired conditions are not quantified in the existing forest plans, in practice Custer Gallatin National Forest would be managed in the spirit of these desired conditions under the current plans (for example, timber harvest would be used as a tool to achieve ecological integrity and resilience). Desired conditions and objectives for terrestrial vegetation were used in the PRISM model as the primary objective of timber harvest in all alternatives and the mix of treatments and volume estimates presented above all reflect the effects of these plan components.

Other plan components associated with terrestrial vegetation such as guidelines related to snags and large tree retention do not outright prohibit timber harvest, but may influence the design or the location of on-the-ground harvest activities. These plan components are the same across all revised plan alternatives and their effect of on timber harvest is generally greater in the revised plan alternatives (for example, guidelines associated with terrestrial vegetation are more restrictive in the revised plan alternatives than the current plans). As such, the effect of terrestrial vegetation plan components on the design and location of timber harvest activities will be more pronounced under the revised plan alternatives than the current plans.

Effects from Fire and Fuels Management

In all alternatives, the plan objectives for fuel reduction are consistent with commercial timber harvest, generally creating more growing space for larger, more fire resistant trees and promotes a landscape that is more resistant to disturbance. Timber harvest is often the tool for reducing fire risk through a reduction in fuel loading. The use of timber harvest to achieve fuels objectives is more likely to occur in the wildland urban interface than other areas and this is the same across all alternatives. Timber harvest also moves vegetation towards desired conditions that are more resilient and less fire-prone. Wildfire may have significant impact on timber supply but this effect will be the same across all alternatives.

Effects from Aquatic Habitat, Riparian, Watershed, Old Growth and Wildlife Management

Measures to protect aquatic habitat, riparian areas, watersheds, old growth, and wildlife will affect the design of timber harvesting operations and may limit the amount of timber that may be harvested. In contrast to the current plans, riparian management zones are not suitable for timber production in all revised plan alternatives and design of harvest operations must protect riparian and aquatic resources. Lynx management guidance does not allow harvest in multi-storied forest except in specified situations;

possibly limits the extent of regeneration harvest depending on how much stand initiation habitat is present; and does not allow pre-commercial thinning in stand initiation habitat. Management guidance for big game, grizzly bears and wildlife connectivity could also affect the design of timber harvest activities. Protection measures for watersheds, aquatic habitat, and wildlife limit the number and size of openings and the type of harvest. These factors may reduce the amount of land available for harvest and/or the type of harvest allowed and is the same across all alternatives. In contrast to the current plans, timber harvest in old growth and riparian management zones is limited to purposes of restoration, protecting values at risk, or addressing human safety in all revised plan alternatives.

Effects from Soils Management

Under all alternatives, plan components related to soils would generally benefit the timber resource by ensuring that soil productivity (and thus, future timber growth) is maintained in the long term. Standards and guidelines related to soils would have the general impact of limiting timber production and harvest in some areas, to the extent that activities that may be detrimental to soils would be restricted (such as repeated compaction, operating equipment on steep slopes, and the like). Such restrictions have been applied to recent timber management activities, and continuing these practices would help sustain future timber production and are generally the same for all alternatives. The revised plan alternatives provide greater specificity in the standards and guides for soils than the current plans, particularly with respect to allowable detrimental disturbance and post-treatment ground cover requirements.

Effects from Recreation Opportunity Spectrum

The acres allocated to summer recreation opportunity settings (ROS) by alternative are shown in table 97 for lands suitable for timber production. Recreation opportunity spectrum allocations regulate motorized and non-motorized recreation, the design of recreation facilities and may influence the design or the location of on-the-ground projects as described in the associated plan components. For example, the desired condition for semi-primitive non-motorized ROS classification is that vegetation management does not dominate the landscape or detract from the experience of visitors. Management restrictions associated with ROS are accounted for in the PRISM model, and therefore their influence on expected timber outputs and harvest acres are expressed in the outputs shown previously.

Table 97. Acres of summer recreation opportunity spectrum classes by alternative, for lands suitable for timber production

Recreation Opportunity Spectrum Class	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Primitive	0%	0%	0%	0%	0%
Semi-Primitive Nonmotorized	11%	9%	9%	6%	11%
Semi-Primitive Motorized	58%	60%	60%	62%	59%
Roaded Natural	26%	26%	26%	27%	25%
Rural	5%	5%	5%	5%	5%

Effects from Scenery Management

In all alternatives, the forest plan scenic integrity objectives (lowest scenic levels allowable) do not outright prohibit on-the-ground actions, but may influence the design or the location of on-the-ground projects that would be visible from any of the listed critical viewing platforms. Design features or mitigations may be required to meet or exceed the assigned scenic integrity objective, which describes the maximum threshold of visual dominance and deviation from the surrounding scenic character.

Cumulative Effects

Many factors influence timber harvest. The demand for timber products, supply from other sources, the timing and location of large disturbance events, laws, and regulations all affect the amount of timber that may be harvested from the Custer Gallatin National Forest. Budgets and court decisions also impact timber supply. The effects that past activities have had on all of the components of forest vegetation (such as, forest composition and structure, landscape pattern, etc.) were discussed in the affected environment section and are reflected in the current condition.

Increasing Human Population

Additional stressors that may increase in the future are increasing population levels, both locally and nationally, with resulting increasing demands and pressures on public lands. Populations on the west side increased between 2000 and 2010 and are expected to continue to grow in the coming decades. Populations on the east side saw minor declines between 2000 and 2010, but are also expected to increase in the coming decades. These changes may lead to increased tensions between the demand for timber and changing societal desires related to the mix of other uses public lands may provide. The sustainable use of other forest products may become increasingly vulnerable, requiring permitting and limitation of use.

Management of Adjacent Lands

Portions of the Custer Gallatin National Forest adjoin other national forests, each having its own forest plan. The Custer Gallatin National Forest is also intermixed with lands of other ownerships, including private lands and state lands. Some geographic areas (GAs) contain significant inholdings of such lands, while others are less divided in terms of ownership. The GAs which are island mountain ranges are largely surrounded by private lands. Harvesting or conversion of forests on adjacent lands would affect vegetation conditions at the landscape level. State law applies to all harvest activities regardless of ownership; therefore, basic resource protections would be consistent. However, harvest practices on other lands, particularly private lands, would not necessarily be conducted to meet the same desired conditions as those outlined in the Custer Gallatin National Forest draft plan.

Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans are summarized in table 98, for those plans relevant to the timber resource. Appendix E contains a summary of all resource plans considered.

Timber Demand

The demand for wood products allows for more cost-effective vegetation management and timber sales from the Custer Gallatin National Forest. If demand for wood products increases, so too will demand for timber sales from the Custer Gallatin National Forest. Alternatively, if demand decreases and mills close, there may be less desire for Custer Gallatin National Forest timber. A decrease in demand may reduce the amount of timber sold regardless of the alternatives. Lower wood quantity may contribute to total public and private land timber supply chain elasticity, especially for mills isolated from other ownership and highly dependent on Custer Gallatin National Forest ownership. If enough timber is collectively removed from markets, it would have the effect of increasing sawlog prices, decreasing operating profits for existing mills.

Table 98. Summary of cumulative effects to timber from other resource management plans

Resource plan	Summary of effects
Forest plans of Adjacent National Forests	The forest and grassland plans for National Forest System lands adjacent to the Custer Gallatin include the Helena Lewis and Clark, Beaverhead-Deerlodge, Caribou-Targhee, Shoshone. All of the forest plans contain plan direction that promotes ecological integrity and meets the requirements of the National Forest Management Act, such as limitations on harvest, reforestation practices, and maximum sized openings. Generally speaking, management of vegetation is consistent across all national forests due to law, regulation, and policy. The cumulative effect would be that the management of vegetation and associated timber harvest would be complementary.
Montana Statewide Forest Resource Strategy; Montana State Parks and Recreation Strategic Plan 2015-2020; Montana's State Wildlife Action Plan	The 2017 revision of the Montana State Forest Action Plan compliments timber management on the Custer Gallatin by including strategies related to increased resilience, wildfire safety, and providing forest products and biomass. The cumulative effect would likely be additive, in terms of the amount of timber harvest treatments that occur across the landscape and in a broad sense moving towards at least some of the vegetation desired conditions as described in the revised forest plan. Montana State Parks and Recreation Strategic Plan guide the management of state parks, some of which lie nearby or adjacent to National Forest System lands. Terrestrial vegetation is a component of these parks, although not always the primary feature. Specific vegetation conditions would not necessarily contribute to the desired conditions as described for the Custer Gallatin. Montana's State Wildlife Action Plan describes a variety of vegetation conditions related to habitat for specific wildlife species. This plan would likely result in the preservation of these habitats on state lands, specifically wildlife management areas. This plan would be consistent with desired conditions of the Custer Gallatin and thus the goals of the timber harvest program.
South Dakota Forest Action Plan Addendum 2015	The 2015 addendum to the South Dakota State Forest Action Plan compliments timber management on the Custer Gallatin by including strategies related to achieving structurally diverse, healthy forests to develop more resilient forest landscapes increased resilience, and wildfire safety; promoting natural species diversity within native forest lands; and providing forest products and biomass.
Bureau of Land Management Resource Management Plans	Bureau of Land Management lands near the Custer Gallatin are managed by the Dillon (2006 plan), Butte (2009 plan), Billings (2015 plan), Miles City (2015 plan) and South Dakota (2015 plan) field offices. These plans components related to resilient terrestrial vegetation are complementary to the plan components for the Custer Gallatin; timber management would be generally conducted in a similar manner and with similar results.
National Park Service - Yellowstone National Park Foundation Document 2014	The foundation document for Yellowstone National Park calls for preserving environmental integrity, which allows natural processes to shape ecosystem functions, resulting in outstanding wilderness character. Broadly, the terrestrial vegetation characteristics in this area are therefore likely similar to the wilderness areas in the adjacent Absaroka Beartooth and Gallatin, Madison, Henrys geographic areas and would complement these conditions. By managing for ecologically based desired conditions and resilience, any timber harvest activities in non-wilderness areas adjacent to Yellowstone National Park would also be consistent with this plan.
County growth plans; comprehensive plan	Many of the county plans associated with the Custer Gallatin emphasize an interest in resilient forests and promoting the use wood products from National Forest System lands as an economic contribution and to enhance the sustainability of forest landscapes. As such, timber harvest and demand would remain important feature in the local communities.
County wildfire protection plans	Some county wildfire protection plans map and/or define the wildland urban interface. The Forest Service notes that these areas may be a focus for hazardous fuels reduction, and other plan components (such as Northern Rockies Lynx Management Direction) have guidance specific to these areas. Treatments, including harvest, may be emphasized in these areas more so than others.

Conclusions

- Timber suitability: The current plans, as updated and amended, has the most amount of land suitable for timber production, and alternative D has the least, but all alternatives are relatively similar ranging from 18 to 22 percent of the Custer Gallatin. In all alternatives, timber harvest has the potential to occur in lands that are unsuitable for timber production to achieve other objectives. Alternative D has the least amount of unsuitable lands where harvest may occur because it has the most recommended wilderness while alternative E has the most total unsuitable lands where harvest may occur.
- Timber supply: Consistent with the themes of the alternatives, alternative E has the highest projected timber and wood sale quantities while alternative D has the smallest. The current plans and alternatives B and C are similar in terms of expected timber outputs. In all alternatives, projected budget assumptions have a significant effect on anticipated volumes and treatment acres.
- Timber harvest: Current plans and alternatives B and C are similar in terms of expected harvest treatment acres. Alternative E would treat fewer acres, but achieve greater volume outputs driven primarily by the selection of different silvicultural prescriptions (more regeneration treatments). Alternative D would treat the highest number of acres, but achieve the lowest timber volume outputs by focusing more resources on prescribed burning and thinning of small diameter trees.

3.16 Special Forest and Botanical Products

3.16.1 Introduction

Special forest and botanical products are mainly plant and fungi materials that are gathered from National Forest System lands for personal use, for commercial resale, or for sale as a craft product.

Regulatory Framework

36 CFR 223.1: states trees, portions of trees, and other forest products on National Forest System lands may be sold for the purpose of achieving the policies set forth in the Multiple-Use Sustained-Yield Act of 1960, as amended, and the Forest and Rangeland Renewable Resources Planning Act of 1974, as amended.

36 CFR 223.239-240, Sale and Disposal of National Forest Timber, Special Forest Products, and Forest Botanical Products: section 223.239 provides regulations of free use without a permit for members of Tribes with treaty or other reserved rights related to special forest products. Section 223.240 provides regulations regarding harvest of special forest products by Tribes with treaty or other reserved rights.

36 CFR 261.6: lists activities regarding timber and other products that are prohibited.

Forest Service Manual 2670, Threatened, Endangered, and Sensitive Plants and Animals: directs national forests to avoid or minimize impacts to species whose viability has been identified as a concern.

Forest Service Handbook 2409.18, chapter 80: provides direction for special forest products.

Key Indicators and Measures

The differences between alternatives will be qualitatively evaluated by considering effects of forest plan direction and how well it supports and benefits people. Differences between alternatives related to gathering opportunities or potential impacts to special forest products are largely linked to the degree of road or trail access and amount of land where gathering special forest or botanical products are allowed.

Methodology and Analysis Process

The analysis included a review of plan components, rules, and regulations for special forest and botanical products and effects. Differences between alternatives were evaluated based on the variation in management area allocations among alternatives as they influence access to and availability or other aspects of special forest products.

Information Sources

This analysis draws upon the best available literature citations that were found to be relevant to the ecosystems on the Custer Gallatin National Forest. Literature sources that were the most relevant, most recent, peer-reviewed, and local in scope or directly applicable to the local ecosystem were selected. Uncertainty and conflicting literature was acknowledged and interpreted when applicable.

Forest Service data is supported by hard-copy files held at the ranger district and forest supervisor's offices for administration of special forest and botanical product authorizations.

Analysis Area

The geographic scope of the analysis is the lands administered by the Custer Gallatin National Forest. All lands within the Custer Gallatin National Forest boundary form the geographic scope for cumulative effects, and the temporal scope is the anticipated life of the plan.

3.16.2 Affected Environment (Existing Condition)

Special forest and botanical products include, but are not limited to, mosses, fungi (including mushrooms), roots, bulbs, berries, seeds, wildflowers, forbs, sedges, grasses, nuts, boughs, cones, transplants, Christmas trees, firewood, posts and poles, mine props, and rails. Some of the most popular special forest and botanical products on the Custer Gallatin are firewood, post and poles, Christmas trees, boughs, and mushrooms.

Existing uses are often tied to historical knowledge and patterns of use. Special forest and botanical products are available through commercial harvest and sale, with some available through free use. Historically, the Custer Gallatin has granted commercial and free use of special forest products to individuals and Tribes with treaty and other reserved rights.

The supply of special forest and botanical products is dependent on ecological conditions and existing distributions of potential growing sites. Forest management or natural disturbances can influence the supply of certain products. For example, fire can increase the availability of firewood and mushrooms, but may decrease the availability of berries in the short term. Thinning of young sapling stands and conifer regeneration after fire or timber harvest can increase production of Christmas trees for a period of time.

Various plant materials are used for foods (for example, morel mushrooms), medicines (for example, echinacea), floral arrangements, ornamentals, contemporary traditional uses, etc. Markets for these various products have fluctuated. Permits may be issued for personal use or commercial use of species. Generally, personal use permits have been issued on the Custer Gallatin National Forest and commercial permits have been avoided. Species proposed for harvest and collection are assessed for the vulnerability and sustainability of the species and pertinent conservation approaches and restrictions are stipulated.

The most common edible mushroom harvested on the Custer Gallatin National Forest is the morel (a fungus of the genus Morchella). Fire prompts morels to fruit, and they are particularly abundant the first year after fire and where the ground has been totally blackened. Though this relationship with fire is well known, the density and distribution of morels within a fire's boundaries can vary widely. The specific environmental factors that cause this fruiting are still largely unknown. Personal or commercial picking of mushrooms on the Custer Gallatin is limited in intensity and extent, largely because of the lack of access, the difficult terrain, and the limited amount (both temporally and spatially) of area where abundant morels occur (such as post-fire conditions).

Echinacea or purple coneflower (*Echinacea angustifolia* var. *angustifolia*) populations are widely distributed across the Ashland and Sioux Districts of the Custer Gallatin National Forest. It is one of the most popular, and most researched, plants in the herbal product industry. Echinacea has traditionally been used for colds, flu, and other infections, based on the idea that it might stimulate the immune system to more effectively fight infection. These plants are slow-growing, long-lived perennials, whose roots are the primary medicinal plant part used in the commercial trade. A sizable portion of the demand for echinacea is for wild-harvested plant material, especially roots of *Echinacea angustifolia*.

Special forest and botanical products have importance to Tribes as traditional and cultural uses. The Sioux, Northern Cheyenne, Crow, Bannack, Shoshone, Nez Perce, Flathead, and Kootenai Tribes have affiliations with the Custer Gallatin National Forest. There are many plant species that have traditional uses as food, medicines, industrials (paint, etc.) and rituals (for example, incense and sweat lodge construction). Tribal members used trees, shrubs, and grasses as part of their survival and knowledge about their use has been handed down through generations. They have developed strong spiritual relationships with plants. Several plant species important to the Tribes important for traditional uses have been identified within the Custer Gallatin.

Based on current handbook direction (Forest Service Handbook 2409.18 sec. 87.13), the Custer Gallatin considers "treaty rights, customary, and traditional uses (including subsistence and other historical uses of plant material by Tribes), the Federal trust responsibility to Tribes, and competitive market demands in determining which products would be excluded from or allowed for sale to commercial harvesters. When there is a shortage of any particular special forest product for tribal use, commercial permits will be issued only to the extent that the tribal use can be accommodated." The Custer Gallatin consults and coordinates with tribal governments prior to issuing any permits, contracts, or other authorized instrument when there is a possible impact to tribal treaty and other rights and interests in the permitted or contracted area (Forest Service Handbook 2409.18 sec. 87.18). The Custer Gallatin honors the unique legal relationship, including the trust relationship, between the Federal government and Indian tribal governments.

The primary non-timber special forest products sold on the Custer Gallatin National Forest include personal use firewood and Christmas trees. Other products, such as mushrooms, boughs, and transplants have been permitted in small quantities and are not a significant portion of the forest products sold on the national forest. Figure 57 displays the volume of fuelwood sold from 1980-2015. From 1980-2015, fuelwood demand per year averages approximately 4.4 MMBF on the Custer Gallatin

National Forest; individually the Custer National Forest averaged 1.2 MMBF per year and the Gallatin National Forest averaged about 3.2 MMBF per year. During the years of 1984-1987 and 1989 fuelwood use averaged approximately 9.5 MMBF. Fuelwood gathering involves the cutting and removing of dead trees for firewood and has been a consistent use by the public of the timber resource on the Custer Gallatin National Forest. Average volumes by decade where higher in the mid to late 1980s, decreasing significantly in the 1990s through early 2000s. During the time period of 2008-2015, demand for firewood has steadily increased and is approaching the average levels set in the mid-1980s. The rise in firewood demand since 2007 could be attributed to the increased number of dead trees available for harvesting following wildfire events, insect or disease outbreaks, and the economic downturn that occurred in 2008.

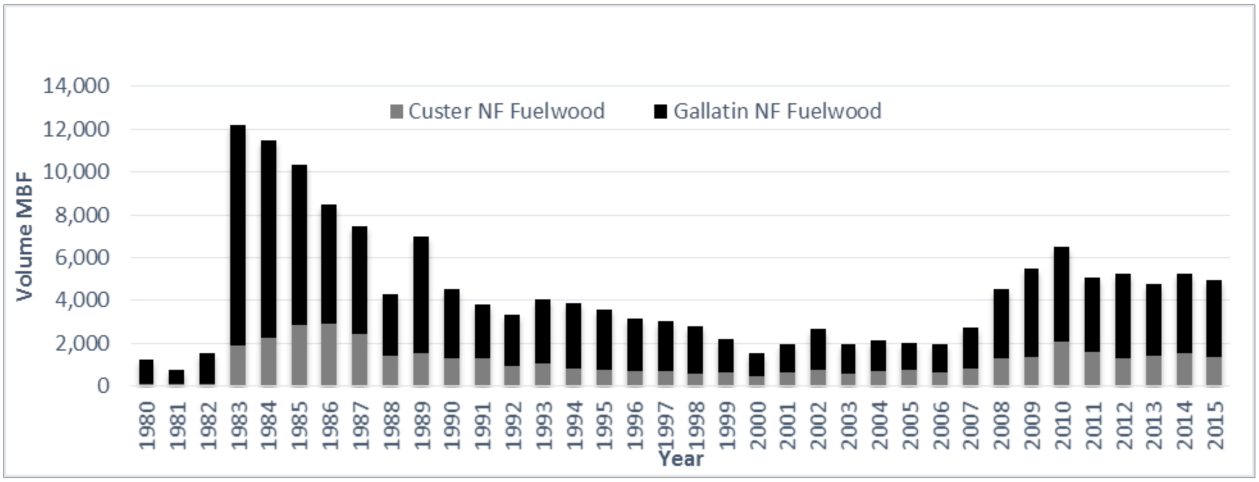

Figure 57. Volume (MBF) fuelwood sold by each national forest 1987-2015

Christmas trees are also a consistent and popular personal use product sold by the Custer Gallatin National Forest. The product sold is tracked by quantity rather than volume. Figure 58 displays the quantity of Christmas trees sold on the Custer Gallatin National Forest for the period of 1980-2015.

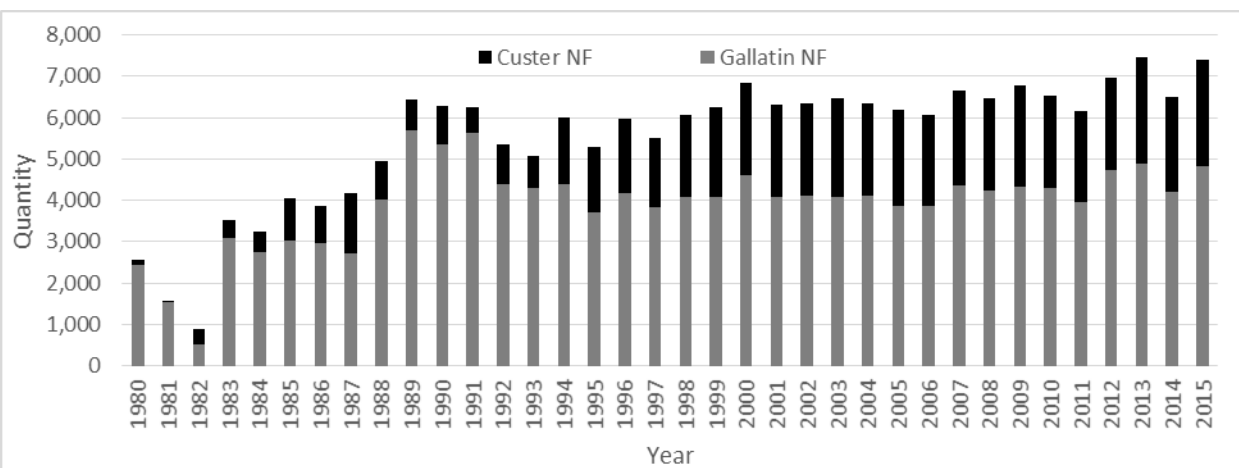

Figure 58. Number of Christmas trees sold by national forest (1980-2015)

On average, the Custer Gallatin National Forest sells approximately 5,518 trees with the Custer National Forest selling approximately 1,600 tree per year and the Gallatin National Forest selling approximately 3,916 trees per year. Prior to 1994, the Custer National Forest sold fewer than 1,000 trees per year, but in subsequent years the Custer National Forest has increased to over 2,000 trees per year. The Gallatin National Forest has maintained selling a consistent stable quantity of approximately 4,000 trees per year. Since 1988 both national forests have been relatively stable in the quantity sold, combined to be between 6,000 and 7,000 trees per year.

Timber products and other forest products are identified as multiple uses and key ecosystem services provided by the Custer Gallatin National Forest. The economy of local communities can directly benefit from the use of these products. Refer to the social and economics section for more information about multiple uses, key ecosystem services, and benefits to people.

3.16.3 Environmental Consequences

Effects Common to all Alternatives

All alternatives contain plan components that protect soil quality and sustain soil ecological functions during activities related to forest products. These components also serve to protect plants, roots, and rhizomes from excessive damage.

Under all alternatives, the forest plan provides direction to provide for sustainable levels of all forest products, including special forest or botanical products. All the revised plan alternatives have components that provide for the sustainable harvest of plant materials by people and encourage the use of non-destructive harvesting methods, as applicable. These serve to protect the current and future availability of plants for both wildlife and human use.

The effects to tribal interests are defined by Tribes during consultation. Current management direction and requirements for consultation have been designed to ensure that areas on National Forest System lands that are important to Native Americans are not inadvertently impacted by the Forest Service. Because management direction is required to follow all Federal laws and regulations in respect to American Indian rights and Interests, related effects are the same across all alternatives. Forest plan components provide for protection of tribal treaty rights related to harvestable plants, including access to the national forest for the effective exercise of gathering rights.

Concerns are sometimes raised about the possible detrimental ecological effects of mushroom picking on, for example, soil conditions, invertebrates, or mushroom productivity. There is little if any scientific evidence that there are any broad adverse ecological effects caused by the picking of mushrooms. On a small, localized scale, intensive gathering by large numbers of people over long periods of time may possibly disturb soils and understory plants, much as could occur at an intensively used recreation site. However, evidence that such harvesting could detrimentally impact mushroom productivity is lacking. A long-term study (over a 27-year period) conducted in a mixed hardwood/fir/pine forest in Switzerland found no difference in species richness or abundance of species of edible fungi in harvested areas compared to non-harvested sites (Egli et al. 2006). The authors did note that very widescale harvesting, in which the depletion of spores over large areas might occur, deserves additional study. A study on post-fire morel abundance in a Sierra Nevada mixed conifer forest found that burned forests in Yosemite National Park alone could produce an average crop of more than 1 million morels per year (Larson et al. 2016).

On the Custer Gallatin, the amount and intensity of mushroom picking is greatly limited by the lack of easy access, the difficult and steep terrain, the periodicity of abundant mushroom crops, and the relative remoteness of the Custer Gallatin when compared to areas adjacent to large cities. It is anticipated that there would be no effect to mushroom productivity or other ecological factors associated with mushroom picking on the Custer Gallatin due to the implementation of the forest plan.

The popularity of echinacea products has repeatedly risen and fallen in recent history, cyclically renewing concerns that unregulated harvesting will decimate wild populations. One study found that root harvests killed half of the plants which suggests potential recovery of these populations, even after severe harvests (Kindscher et al. 2008). Full population recovery would require a period of at least two years without harvest plus the combination of root resprouting, seed bank germination, and small plants reaching flowering size. This same study suggested that with responsible harvest techniques, the harvest and removal of echinacea can be sustainable.

The expected change in climate in future decades could influence the availability of some special forest products. Insofar as it alters the growing conditions of a site, climate change could influence presence and productivity of plants. Increased frequency or severity of fire could also cause changes or shifts on the landscape in terms of plant species composition or abundance. More firewood might be available with the increased size or frequency of fire, but an increase in fire might eliminate other special products, at least over the short term. Uncertainty exists regarding the possible effects of climate change on vegetation and thus on the availability and distribution of plants that are gathered as special forest products.

Current Plans

Management Direction under the Current Plans

Under the 1986 Custer Forest Plan, extraction of indigenous plant materials can be allowed under permit, either free-use or charge, depending upon the location and demand. The 1987 Gallatin Forest Plan did not address forest products and plant materials.

Under the current plans, personal use of special forest products is allowed across the Custer Gallatin, except in Research natural areas, so long as the use does not conflict with other management guidance. Commercial use of special forest or botanical products is not be allowed in designated wilderness, wilderness study areas, recommended wilderness areas, research natural areas, or wild segments of designated or eligible wild and scenic rivers and special areas. In addition, commercial use firewood, post and poles, teepee poles, and biomass / wood fiber permits within developed recreation sites is not allowed. Current plans retain the existing amount of motorized use.

Effects of the Current Plans

Forest plan direction under the Custer Plan and policy are designed to support sustainable levels of special forest and botanical products.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

All revised plan alternatives contain the same plan components for special forest products. They were developed under the 2012 Planning Rule, and all revised plan alternatives provide direction for sustainable levels of special forest products.

Similar to the current plans, personal use of special forest products would be allowed across the Custer Gallatin, except in research natural areas, so long as the use does not conflict with other management guidance. Commercial use of special forest or botanical products would not be allowed in designated wilderness, wilderness study areas, recommended wilderness areas, research natural areas, or wild segments of designated or eligible wild and scenic rivers and special areas. Commercial use firewood, post and poles, teepee poles, and biomass and wood fiber permits within developed recreation sites would not be allowed.

In addition, under the revised plan alternatives, firewood gathering in inner riparian management zones would not be allowed.

Effects of the Revised Plan Alternatives

Under all revised plan alternatives, forest plan components and policy are designed to support sustainable levels of special forest and botanical products.

Consequences to Special Forest and Botanical Products from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Vegetation and Timber Management

Timber harvest and other vegetation management objectives may increase or decrease the availability of some special products. For example, the availability of Christmas trees may be increased after regeneration harvest. Firewood may increase, either due to an increase in commercial firewood sales or as a byproduct of other commercial timber sales. All alternatives propose harvest to some amount, and would have opportunity to affect the availability of associated products. Roads associated with timber harvest has potential to provide permanent or temporary access which can accommodate easier access to special products. Although these desired conditions are not enumerated in the existing 1986 and 1987 forest plans, in practice Custer Gallatin National Forest would likely be managed in the spirit of these desired conditions.

Effects from Fire and Fuels Management

The current plans' fire management direction are to consider multiple fire management strategies. Revised plan alternative direction for natural, unplanned ignitions would continue the long-term ecological processes in these areas. Under all alternatives, fire may increase or decrease the potential availability of some special forest products, such as mushrooms and firewood. Future potential wildfire patterns and amounts have a relatively high degree of uncertainty; and a range of possible wildfire acres are projected to be about the same for all alternatives. Therefore, all alternatives would have similar potential to provide for some special forest products linked to fire events, specifically firewood, and mushrooms.

Effects from Access and Recreation Management

In all alternatives, limits related to motorized trailed access as well as construction of new roads (both permanent and temporary) could impact the ease of access to special forest products on portions of the Custer Gallatin.

Although roads or trails are not necessary for the removal of special forest or botanical products, they generally make it easier to access forest lands and areas where special products may be gathered. Therefore, areas that tend to have greater road or trail access, particularly wheeled motorized access, may be expected to provide greater opportunities to gather special forest products. Conversely, the potential for over-harvesting special forest or botanical products in some areas may increase with greater access. Table 99 displays the change in miles available to motorized and mechanized recreation use by alternative.

Table 99. Change from current conditions; miles of motorized roads, miles of trail no longer available to motorized recreation use and miles of trail no longer available to bicycle use by alternative

Access Type	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Motorized Roads	No Change	No Change	No Change	No Change	No Change
Motorized Use of Trails	No Change	No Change	4	172	No Change
Bicycle Use of Trails	No Change	No Change	20	256	No Change

There are no changes to open motorized road and trail routes in the current plans, alternatives B, or E. Under alternative C, about four miles of trails would no longer be available for motorized recreation use. Under alternative D, about 172 miles of trails would no longer be available for motorized recreation use.

There are no changes to open non-motorized routes in the current plans, alternative B or alternative E. Under alternative C, about 20 miles of trails would no longer be available for bicycle use. Under alternative D, about 256 miles of trails would no longer be available for bicycle use.

Under all alternatives, gathering of special forest products for personal use is allowed over the vast majority of National Forest System lands. Though wheeled motorized access is limited, hiking is not. Biking or horseback riding are also widely available forms of access to lands for gathering of special forest and botanical products.

Effects of Land Allocations

Under all alternatives, special forest and botanical products may not be collected for commercial or noncommercial personal use in research natural areas. Under all alternatives, with the exception of research natural areas, personal use of special forest products would be allowed across the Custer Gallatin, so long as the use does not conflict with other management guidance. Under all alternatives, commercial use of special forest and botanical products is not allowed in designated wilderness, “wild” portions of designated or eligible wilderness study areas, recommended wilderness, research natural areas and special areas. The differences between alternatives is driven primarily by the acres included as recommended wilderness areas. The following table displays the acres by alternative where commercial use of special forest and botanical products is not allowed. Forty-two to 65 percent of the Custer Gallatin is unavailable for commercial use of special products depending upon the alternative. Commercial use of special products is allowed to the greatest degree in alternative E, and to the least in alternative D. Similar amounts of land are available under the current plans, alternatives B, C, and E ranging from 53 to 58 percent, while alternative D provides 35 percent of the Custer Gallatin being available for commercial use of special products.

Table 100. Approximate acres of areas where commercial use of special forest and botanical products is not allowed and percent of forest by alternative

Area	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Commercial Use Not Allowed in: Wilderness Areas, Wilderness Study Areas, Recommended Wilderness Areas, Research Natural Areas; Special Areas; Wild Portions of Wild and Scenic Rivers[2]	1,300,993	1,380,930	1,413,528	1,978,211	1,267,252
Percent of Forest (3,039,279 NFS acres) where commercial use of Special Products is not allowed	43%	45%	47%	65%	42%

1. Due to mapping limitations, these figures did not include acres of developed recreation sites or inner riparian management zones where commercial uses are also not allowed
2. Designated and eligible wild and scenic rivers: not allowed in wild sections; allowed in scenic and recreation sections

Cumulative Effects

Neighboring land ownerships and various restrictions could affect pressure for commercial and personal use of forest products from National Forest System lands.

Gallatin, Park, Sweat Grass, Stillwater, and Carbon counties (Montana) have experienced high rates of population growth over the past couple of decades. With this increased growth rate comes increased pressure on National Forest System lands for a variety of social needs and desires, including the use of special forest products. The sustainable use of some of these resources may become increasingly vulnerable, requiring permitting and limitation of use.

Conclusion

Under all alternatives, personal use of special forest products would be allowed across the Custer Gallatin, except in research natural areas, so long as the use does not conflict with other management guidance. Under all alternatives, gathering of special forest products for personal use is allowed over the vast majority of National Forest System lands. Though wheeled motorized access is limited, hiking is not. Biking or horseback riding are also widely available forms of access to lands for gathering of special forest products.

Under all alternatives, commercial use of special forest or botanical products would not be allowed in designated wilderness, wilderness study areas, recommended wilderness areas, research natural areas, or wild segments of designated or eligible wild and scenic rivers and special areas. In addition, commercial use firewood, post and poles, teepee poles, and biomass and wood fiber permits within developed recreation sites are not allowed. Also, under all revised plan alternatives, all firewood gathering in inner riparian management zones is not allowed.

Differences between alternatives related to gathering opportunities or potential impacts to special forest products are largely linked to the degree of road or trail access and amount of land where special forest or botanical products are allowed. Commercial use of special products is allowed to the greatest degree in alternative E, and to the least in alternative D. Similar amounts of land are available for commercial use under the current plans, alternatives B, C, and E ranging from 53-58 percent, while alternative D provides 35 percent of the Custer Gallatin being available for commercial use of special products.

Forest plan components provide for protection of tribal treaty rights related to harvestable plants, including access to the Custer Gallatin for the effective exercise of gathering rights.

The forest plan provides direction to provide for sustainable levels of all special forest and botanical products. All the revised plan alternatives have forest plan components that provide for the sustainable harvest of plant materials by people and encourage the use of non-destructive harvesting methods, as applicable.

3.17 Energy, Minerals, and Geologic Areas of Interest

3.17.1 Introduction

The following information forms the basis of both the affected environment and environmental consequences pertaining to renewable and nonrenewable energy, mineral resources, and geologic areas of interest found across the Custer Gallatin National Forest. Topics discussed address items required by the Forest Planning Rule (36 CFR Part 219) and also those considered important to future management of geologic and minerals resources and issues over the life of the ensuing forest plan. The diversity of topics included is reflective of the energy and minerals resources, geologic issues, and geographic diversity represented across the 400 miles of the Custer Gallatin National Forest. An overview of forest geology is not included, although the types and arrangement of rocks underlying the national forest directly influences the presence or absence of mineral and energy resources. The information presented within this section draws from a detailed report pertaining to these same considerations and is found in the Renewable and Nonrenewable Energy and Mineral Resources Assessment Report (Pierson 2017).

Regulatory Framework

A variety of Federal mineral, energy, and geologic resource laws and resource management regulations and policies directly influence the development of mineral and energy resources and the management of geologic resources and hazards within the Custer Gallatin. A brief overview of this information is provided below.

The authority to manage and regulate the exploration and development of mineral and energy resources within National Forest System (NFS) lands is jointly shared between the secretary of agriculture and the secretary of the interior. The regulatory framework for mineral and energy resource exploration and extraction depends upon the type of commodity, the surface and mineral estate ownership, and the land status (public domain or acquired). The Forest Service has authorities to administer minerals on both public domain and acquired lands. Public domain lands are those that have never left Federal ownership/jurisdiction. These lands, unless they are subject to a mineral withdrawal, are open to mineral entry under the Mining Laws.

The primary laws which govern minerals management on Federal lands are briefly discussed below. A much more exhaustive listing of Federal laws pertaining to the management of National Forest System Lands inclusive of mineral resources is contained in the Renewable and Nonrenewable Energy and Mineral Resources Assessment Report (Pierson 2017).

General Mining Law of 1872: authorizes placer and lode mining claims, mill sites and tunnel sites of specific dimensions and a patenting process. This act sets forth the principles of discovery, right of possession, assessment work, and patent for hardrock minerals on lands reserved from the public domain. Except as otherwise provided, all valuable mineral deposits, and the lands in which they are found, are free and open to exploration, occupation, and purchase under regulations prescribed by law (FSM 2810).

Organic Administration Act of June 4, 1897 (30 Stat. 11, as amended; 16 U.S.C. 473-475, 477-482, 551): provides the secretary of agriculture the authority to regulate the occupancy and use of National Forest System lands. It provides for the continuing right to conduct mining activities under the general mining laws if the rules and regulations covering National Forest System lands are complied with. This act recognizes the rights of miners and prospectors to access National Forest System lands for all proper and lawful purposes; including prospecting, locating, and developing mineral resources.

Mineral Leasing Act of 1920 as amended: provides that deposits of laterally extensive minerals such as coal, oil, gas, and phosphate can be acquired through competitive leasing systems.

Mining Act of July 23, 1955 (69 Stat. 368; 30 U.S.C. 601 et seq.): requires the disposal of common varieties of sand, stone, gravel, pumice, pumicite, and cinders under the provisions of the Materials Act of July 31, 1947, and gives to the secretary of agriculture the authority to dispose of these materials. It also provides that rights under any mining claim located under the mining laws are subject to the right of the United States to manage and dispose of surface resources.

Multiple Use Mining Act of 1955 (30 U.S.C.611-615): authorizes the Forest Service to restrict mining operations on National Forest System lands to only those uses reasonably incident to mining and in a manner that minimizes adverse environmental impacts.

Mining and Minerals Policy Act of December 31, 1970 (84 Stat. 1876; 30 U.S.C. 21a): states that the continuing policy of the Federal government is to foster and encourage private enterprise in the development of economically sound and stable domestic mining and minerals industries and the orderly and economic development of domestic mineral resources.

Title 36, Code of Federal Regulations, Part 228: set forth rules and procedures governing use of the surface of National Forest System lands in conjunction with operations authorized by the general mining laws, and mineral material disposal laws.

Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA) (94 Stat. 2767; 42 U.S.C. 9601, et seq): provides authority to the Environmental Protection Agency and to other Federal agencies, including the United States Department of Agriculture, to respond to release of hazardous substances, pollutants, and constituents. It also provides for joint and several liability to potentially responsible parties (PRPs) for cleanup costs of existing water contamination (FSM 2160).

Energy Policy Act of 2005 (Pub. L. 109–58): addresses energy production in the United States, including: (1) energy efficiency; (2) renewable energy; (3) oil and gas; (4) coal; (5) tribal energy; (6) nuclear matters and security; (7) vehicles and motor fuels, including ethanol; (8) hydrogen; (9) electricity; (10) energy tax incentives; (11) hydropower and geothermal energy; and (12) climate change technology.

Paleontological Resources Preservation subtitle of the Omnibus Public Land Management Act, 16 U.S.C. 470 aaa to aaa-11 (2009): provides for the preservation, management, and protection of paleontological resources on National Forest System lands (NFS), and ensures that these resources are available for current and future generations to enjoy as part of America's national heritage.

Federal Cave Resources Protection Act (FCRPA) of 1988: states that it is the policy of the United States that Federal lands be managed in a manner which protects and maintains, to the extent practical, significant caves. The purposes of the FCRPA are (1) to secure, protect, and preserve significant caves on Federal lands for the perpetual use, enjoyment, and benefit of all people; and (2) to foster increased cooperation and exchange of information between governmental authorities and those who utilize caves located on Federal lands for scientific, educational, or recreational purposes. The FCRPA is guided by implementing regulations at 36 CFR Part 290 – Cave Resources Management.

Key Indicators and Measures

- restrictions that could affect energy and mineral development, such as timing and access restrictions, measured in relative acres between alternatives where new road building is not allowed
- area unavailable for extraction of salable mineral material, measured in relative acres between alternatives

Methodology and Analysis Process

The differences between alternatives are evaluated by considering effects of forest plan direction and how well it supports or limits energy and mineral development and geologic resources. Effects for minerals development activities are assessed for different alternatives and specifically for areas that have been identified as not suitable for salable mineral materials and those areas where new road construction is not allowed. Salable mineral materials availability would vary by alternatives. Restrictions on road building are assumed to make permitting more expensive and time consuming and likely result in a more expensive mining operation. Mineral development in recommended wilderness and other special areas would have more opposition from the public and would result in additional constraints on the mining operation and time for environmental analysis. Locatable and leasable minerals availability does not vary by alternative.

Mineral encumbrances; reserved and outstanding private mineral rights, active and suspended oil and gas leases, and mining claims that may occur in recommended wilderness areas are analyzed in the Recommended Wilderness Area section. All of these have the right to access the national forest to explore for and develop the minerals, regardless of any plan component that restricts access or road building or other activities.

The analysis of renewable and non-renewable energy and mineral resources considers lands that comprise the Custer Gallatin National Forest yet are not currently managed as wilderness or have otherwise been withdrawn from locatable mineral actions to be available for multiple use management.

Assumptions used in this analysis include the accuracy of data used at the time this analysis was prepared. Mineral rights data, especially the mining claims for locatable minerals, are always changing, so the analysis is a snapshot in time.

Information Sources

This analysis draws upon appropriate and applicable data found to be relevant to the geologic conditions found on the Custer Gallatin National Forest. The analysis uses data contained within Forest Service and

Bureau of Land Management data bases. These data sources have been incorporated into the corporate Geographic Information System (GIS) used by the Custer Gallatin. A variety of mapping and analysis products were generated and this information has been used in the effects analysis.

Analysis Area

The geographic scope of the analysis is all National Forest System lands within the Custer Gallatin National Forest boundary. Cumulative effects consider neighboring national forest and Bureau of Land Management land jurisdictions. The temporal scope is the anticipated life of the plan.

3.17.2 Affected Environment (Existing Condition)

Locatable Minerals

Locatable minerals include both metallic minerals (gold, silver, copper, zinc, nickel, lead, platinum, etc.) and nonmetallic minerals (fluorspar, asbestos, gypsum, mica, locatable grade limestone, pumice, etc.) and certain uncommon variety minerals. The General Mining Law of 1872 provides the right to prospect, explore, and develop minerals on public domain lands open to mineral entry. The right of access for exploration and development of locatable minerals is also guaranteed, although the Forest Service may condition this right. If the land is open to mineral entry and a mining claim is properly filed with the Bureau of Land Management and the local county, the claimant has legal title to the mineral.

Locatable Mineral Activities on the Custer Gallatin National Forest

Currently, there are numerous authorized locatable mineral activities, such as exploration or production operations for locatable minerals within the boundaries of the Custer Gallatin. Approved locatable mineral operations range in scope from large underground mines (Stillwater Mining Company) to very small dredging and hardrock exploration programs. Over the last 20 years (1995-2015) the Custer Gallatin has processed and administered 5 to 10 plans of operations annually. The majority of these activities have occurred within the Stillwater Complex, on the Yellowstone and Beartooth Districts.

Two large-scale hard rock underground mines are located within the Stillwater Complex along the northern margins of the Beartooth Plateau. Both of these mines produce platinum and palladium minerals and are operated by the Sibayne Stillwater Mining Company. These two mines represent a significant source of employment within and adjacent to the Custer Gallatin National Forest. The scale and grade of the ore deposit suggest that, at a minimum, mining activities should continue throughout the forest planning horizon and likely in excess of 30 years.

Locatable mineral mining and exploration activities are proposed or ongoing in areas within and immediately adjacent to the Custer Gallatin. Most notable are exploration activities within the Crevice/Jardine and Emigrant areas, as well as ongoing locatable grade limestone mining adjacent to the Pryor Mountain assessment area. Recent interest in placer exploration has been taking place within the Emigrant Creek and the Gardiner/Jardine areas. Other small-scale placer activity is ongoing in the Boulder River drainage.

Locatable Mineral Withdrawals

The Custer Gallatin National Forest contain lands that have been withdrawn from mineral entry; therefore exploration, development, and production of locatable mineral resources is not allowed. These areas consists of administrative sites, existing ski areas, campgrounds or other areas of capital improvements, areas with other outstanding natural resource values, and wilderness areas. Both original Custer (Appendix IV) and Gallatin (Appendix D) Forest Plans included listings of sites where locatable mineral withdrawals had been enacted. In total, 81 sites were identified in both forest plans.

Since that time additional locatable mineral withdrawal areas have been identified and/or approved. The largest land positions currently withdrawn from mineral entry within the Custer Gallatin include the Absaroka-Beartooth Wilderness (917,474 acres) and Lee Metcalf Wilderness (133,848 acres) Areas. Additional areas of locatable mineral withdrawals have been approved since both forest plans were approved in the mid-1980s. Approximately 26,223 acres of Federally owned lands and interests in lands within the New World Mining District have been withdrawn from all forms of entry, appropriation, and disposal under the public land laws, from location, entry and patent under the mining laws, and from disposition under all mineral and geothermal leasing laws. A locatable mineral withdrawal for the Emigrant and Crevice areas within the western margins of the Absaroka Beartooth Geographic Area of the Custer Gallatin which totals 30,370 acres has recently been approved. These lands have been withdrawn from location and entry under the United States mining laws for a period of 20 years, subject to valid existing rights. The lands have been and will remain open to leasing under the mineral leasing and geothermal leasing laws. Many smaller areas throughout the Custer Gallatin have been withdrawn from mineral entry. A total of 1,107,915 acres of National Forest System land has been withdrawn from mineral entry (not including the smaller withdrawal areas) within the 3,039,273 acres of the Custer Gallatin National Forest.

Leasable Minerals

Leasable mineral commodities (both renewable and non-renewable) include oil, gas, coal, geothermal, potassium, sodium phosphates, oil shale, sulfur, and trona on public domain lands. Solid minerals, including locatable minerals, on acquired lands are leasable. Leasable public domain minerals are leased under authority of the Mineral Leasing Act of 1920, as amended. Acquired minerals are leased under the authority of the 1947 Mineral Leasing Act for Acquired Lands (1947 Act), as amended.

Oil and Gas

The Bureau of Land Management issues all leases for the production of federally owned oil and gas minerals on National Forest System land with consent from the Forest Service. Forest Service regulations at 36 CFR 228, Subpart E, establishes the process for making oil and gas leasing decisions in accordance with the Federal Onshore Oil and Gas Leasing Reform Act of 1987. Under the Federal Coal Leasing Amendments Act of 1975, Forest Service consent is required for a coal license or lease. Whether public domain or acquired lands, pursuant to the Geothermal Steam Act of 1970, Bureau of Land Management may lease geothermal resources after obtaining consent from the Forest Service.

Oil and Gas Activities, Existing Leases, and Lease Nominations on the Custer Gallatin – The majority of the Custer Gallatin does not have a current oil and gas leasing analysis necessary to offer leasable mineral resources for lease sale. Only the South Dakota portion of the Sioux District currently has an oil and gas leasing environmental impact statement and record of decision. Currently, the Custer Gallatin National Forest has 86 authorized leases (totaling 116,594 acres) located within the national forest. Approximately 100,531 of these leased acres are located on the western portion of the Custer Gallatin, but have been suspended from further activities, as a result of legal challenges discussed below under the subject area entitled suspended oil and gas lease activities on the Custer Gallatin.

The remaining 16,062 acres of authorized leases are located on the Sioux District portion of the planning area. All portions of the South Cave Hills unit were leased in January 2009. To date, no applications for development for these 2009 leases have been received. The Sioux District contains three existing oil and gas wells. One is a saltwater disposal well, while the other two produce leasable mineral resources. Currently, no leasable mineral exploration activity exists on the Custer Gallatin.

The Custer Gallatin National Forest also has a number of pending leases which are areas that have been nominated for lease sale by the oil and gas and coal bed methane industry, but no leasing action has taken place (total acreage of pending leases is 96,090 acres). Acreage totals by district are Ashland – 19,057, Sioux – 60,143, Beartooth – 6481, Big Timber – 160, Bozeman – 3174 and Yellowstone – 7076. Forest Service priorities for oil and gas leasing environmental analyses are based on public desire for action, applications for permits to drill on existing leases, and available funding. No environmental analysis for oil and gas leasing will be conducted as part of this plan, however the plan sets the stage for future analysis for leasing.

Suspended Oil and Gas Lease Activities on the Custer Gallatin – The secretary of interior suspended oil and gas leases which had previously been sold in 1985 as a result of the Conner v. Burford district court decision [Conner v. Burford, 605 F. Supp. 107 (D.Mont.1985)]. The court found the environmental effects analysis supporting lease issuance on the Gallatin and Flathead National Forests to be inadequate. The court specified that no activity may take place on the leases until an environmental impact statement is completed. The 9th Circuit Court of Appeals upheld the district court decision to require an environmental impact statement prior to any post leasing activities in a January 13, 1988 decision, as amended July 1, 1988. Therefore, no oil and gas exploration drilling or development can be undertaken on these leases until an environmental impact statement is completed. This analysis was never conducted and a leasing decision will not be a part of this analysis.

As of April 4, 2016, 68 suspended oil and gas leases covering 100,531 acres are located within forest. These suspended leases are found within the Madison, Henrys, Gallatin, and Absaroka Beartooth Mountain forest planning subunit on the Bozeman (51 leases; 77,203 acres), Gardiner (1 lease; 480 acres), and Livingston (16 leases; 22,848 acres) Districts (Hunt 2018, pers. comm.).

Coal Deposits

Significant coal deposits are found within the Powder River Basin of southeastern Montana; the Ashland District is located within this area. The Powder River Basin contains the largest occurrence of low-sulfur, low-ash, subbituminous coal in the United States and is the single most important coal basin in the United States.

The Ashland District and to a lesser degree, the Sioux District contain the coal resource found on the Custer Gallatin. Coal deposits of the Ashland District are best described as sub-bituminous while coal within the Sioux District is classified as lignite. No expressed interest in leasing or development of coal within the Ashland or Sioux Districts have been received. Given the coal occurrence, current price, and coal market conditions, future coal development is not foreseeable.

Coalbed Methane

Bureau of Land Management assessments related to coalbed methane occurrence and development potential have been conducted for lands encompassed within the current forest planning assessment area. Areas which were identified as having a high occurrence and development potential were generally located within the Ashland District, within the Powder River Basin of southeastern Montana. Areas which were identified as having a moderate occurrence and development potential related to coalbed methane include the Bangtail and northern portions of the Absaroka Mountain areas due to the occurrence of cretaceous aged coals of sufficient thickness. Although there have been lease nominations for coal bed methane, no leasing has occurred. Since the time of the interest in leasing, the coal bed methane industry has declined significantly due to more cost effective sources of natural gas production.

Geothermal

Geothermal resources are defined as all products of geothermal processes including indigenous steam, hot water or hot brines, steam and other gases, heat or other associated energy found in geothermal formations, and any byproducts (43 CFR 3200). Renewable energy minerals on National Forest System lands are made available through issuance of leases similar to nonrenewable energy resources leasable minerals.

A nationwide programmatic final environmental impact statement for geothermal leasing in the western United States was prepared which identified lands that would be made available for issuance of geothermal leases. A record of decision was issued by the Bureau of Land Management and the Forest Service in 2008 (USDI BLM, USDA FS 2008). The analysis identified National Forest System lands that are legally open or closed to geothermal leasing in twelve western states, including the Montana portions of the Custer Gallatin. The South Dakota portion of the planning area was not considered in this nationwide programmatic final environmental impact statement.

Certain lands may be excluded from geothermal leasing on the basis of existing laws, regulations (see 43 CFR 3201.11) and Executive Orders. These non-discretionary closures are typically associated with designations of national monuments, wilderness areas, and some wilderness study areas. Since the South Dakota portion of the Custer Gallatin was not considered within the PFEIS for geothermal leasing, a separate geothermal leasing environmental impact statement would need to be conducted prior to leasing or development.

Potential for enhanced geothermal system development on the Custer Gallatin ranged from low to high suitability. Most of the lands which are attractive from a geothermal perspective are associated with known hot springs or elevated water temperatures at depth in the far eastern portions of forest.

Renewable Energy Resources

In 2013, the National Renewable Energy Laboratory (NREL) completed an assessment of the potential for solar and wind energy development on National Forest System lands entitled Analysis of Renewable Energy Potential on U.S. National Forest Lands (Zvolanek et al. 2013). Authorization and permitting of both wind and solar renewable energy activities is conducted under the Forest Service’s Special Use program. Management direction and authority for generation, transmission, and distribution of electric energy is provided by the Federal Land Policy and Management Act of 1976 (FLPMA). Additionally, the Energy Policy Act of 2005 (section 211) recognizes the Forest Service’s role in meeting the renewable energy goals of the United States. The use and occupancy of National Forest System lands for renewable energy production, such as solar and wind energy development, are appropriate.

Wind Power

National Forest System lands were evaluated for potential suitability for wind energy development (Zvolanek et al 2013). Montana and western South Dakota have substantial potential for wind generation. The planning area was found to have potential for the development of wind energy due to the available resource and proximity to transmission lines (US Department of Energy NREL 2005).

Nationwide, the eastern side of the Custer Gallatin was identified as one of the top ten National Forest units with the most potentially suitable land for wind development, with 139,243 acres which could produce 2,785 MW of wind generated energy (assuming 50 acres/MW). The lands within the western side of the Custer Gallatin were estimated to have 3,678 acres of potentially suitable land for wind development which could potentially generate 75 MW of wind generated energy (assuming 50 acres/MW).

Solar Power

The Custer Gallatin does not have a high potential for the development of solar energy (US Department of Energy NREL 2005 and Zvolanek et al 2013). The lands on the eastern side of the Custer Gallatin have a maximum development potential for photovoltaic solar energy of 69,929 acres with potential to generate 1415 MW of energy (assuming 1 MW per 5 acres). The lands on the western side of the Custer Gallatin are estimated to have 49,410 acres of maximum development potential for photovoltaic solar energy with 1000 MW (assuming 1 MW per 5 acres).

Hydropower

Hydropower accounts for 36 percent of electricity generation in Montana and 40 percent in South Dakota (National Hydropower Association 2016). The permitting and licensing of hydropower projects is overseen by the Federal Energy Regulatory Commission (FERC). Because the construction and operation of hydropower facilities hold significant implications for the environmental, cultural, and economic resources in a river system, projects undergo a rigorous review with input from stakeholders including Federal and State agencies.

The western, mountainous portions of the Custer Gallatin have the highest potential for hydropower development and generation due to topographic characteristics of the terrain. These areas typically receive a relatively constant precipitation as compared to prairie ecosystems located in the eastern portions of the Custer Gallatin. The eastern portions have limited localized opportunities for development of hydropower energy generation. As evidenced by the public reaction to recent proposal for hydropower development in the East and West Rosebud drainages on the Beartooth District, significant local opposition to hydropower proposals are likely to take place.

Hydropower Facilities – Two renewable energy facilities are located within the Custer Gallatin National Forest. The Mystic Lake hydroelectric dam, located on the West Rosebud River, Beartooth District, has been in operation since 1924. Mystic Lake Dam is a two-unit hydroelectric plant and is classified as a storage generation project because it uses the water stored in its reservoir to generate electricity. Mystic Lake Dam is permitted by Federal Energy Regulatory Commission through 2050. Upgrades to the original turbines enable the facility to generate up to 11.8 megawatts.

Hebgen Lake, located on the Hebgen Lake District, serves as a storage reservoir, which provides water release from a 905-square-mile drainage area at the headwaters of the Madison-Missouri river system. These water releases, flow into eight downstream Montana hydroelectric plants. While operation of

Hebgen Lake dam is used to regulate the flow of water into the Madison-Missouri system, it does not specifically generate hydropower.

Permits were granted by Federal Energy Regulatory Commission (FERC) to study hydropower project feasibility on East Rosebud and West Rosebud Creeks on the Beartooth District and Quake Lake Reservoir on the Hebgen Ranger District (FERC 2016). No special use permit applications for feasibility studies have been received by the Forest Service to date. There are no other known, pending or proposed hydroelectric permits, projects, dams or storage reservoirs, or other renewable energy projects on the Custer Gallatin.

Salable Mineral Materials

Salable mineral materials, such as common varieties of sand, stone, gravel, cinders, clay, and pumicite that are reserved from the public domain fall under the Materials Act of 1947. The associated Forest Service regulations(36 CFR 228, Subpart C) provide for disposal of mineral material on public lands through competitive sale, negotiated contracts, free use, and Forest Service force account or contract (36 CFR 228.57). The salable mineral material policy, as specified in FSM 2850-3, states that disposal of mineral material will occur only when the authorized officer determines that the disposal is not detrimental to the public interest and that the benefits to be derived from a proposed disposal would exceed the total cost and impacts of resource disturbance.

The Custer Gallatin uses mineral materials, such as gravel, riprap, and crushed aggregate in routine maintenance and new road construction, recreation sites, and trailheads. Other uses may include forest contract work, culvert replacement, and repairs of damage caused by fire, floods, landslides, and abandoned mine reclamation. Additionally, the Custer Gallatin annually issues approximately 75 personal use mineral material permits for landscape rocks and other materials. Additionally, approximately 100 petrified wood minerals material permits are issued each year.

Mineral Encumbrances on the Custer Gallatin

The Custer Gallatin National Forest contains four different types of encumbrances of the subsurface minerals estate. There are both reserved and outstanding private mineral rights on acquired lands. There are also active and suspended oil and gas leases and mining claims under the 1872 Mining Law. All of these mineral rights have the right to access the land to explore for and develop the minerals. Many plan components for other resources have stipulations stating that no new roads will be constructed; this stipulation would not apply to these outstanding mineral rights.

The reserved and outstanding mineral rights occur on acquired lands that are split estate, Federal surface, and private subsurface. Reserved mineral rights are those that a private landowner kept when they sold the property to the United States. Reserved minerals are managed based on the secretary of agriculture’s rules and regulations. Outstanding minerals are those minerals that were separated from the surface estate sometime in the past. Outstanding minerals are subject to state law and conditions stated in the original deed conveying the minerals. In both of these cases, the Forest Service has little control over the access and mineral activities for these private mineral rights.

As discussed above, the Custer Gallatin has 86 authorized oil and gas leases (includes suspended and active leases) totaling 116,594 acres. Approximately 100,531 acres of suspended oil and gas leases acres are located on the western portion of the national forest. Approximately 16,062 acres of active leases are located on the Sioux District.

Hardrock mining is regulated by the 1872 Mining Law and state and Federal regulations. Reasonable access to valid mining claims is guaranteed under the mining laws. Mining claims are located across the Custer Gallatin with the majority being located in the Stillwater Complex, Jardine, and Crevice areas.

Geologic Areas of Interest

Geologic areas of interest include geologic resources, caves and karst, paleontological resources, and geologic hazards. Geologic resources consist of interesting and unusual geologic occurrences such as exposed faulting and deformed rocks showing tectonic movement and glacial features such as U shaped valleys and glacial lakes. Caves and karst geology is a forest resource that has been inventoried and is being actively managed.

The Custer Gallatin contains differing geologic conditions characterized by mountainous terrain in the western and central portions, which have significant occurrences of igneous and metamorphic rocks. The eastern portions (Ashland and Sioux Districts) are characterized by relatively flat lying sedimentary geologic units. On the Custer Gallatin, many geologic areas of interest contribute to landscape diversity. Broad categories of geologic areas of interest include geologic resources, caves and karst resources, paleontological resources, and geologic hazards.

Noteworthy examples of geologic resources include:

- Well exposed large-scale faulting which formed the mountain ranges found throughout the western and central portions of the planning area.
- Prominent Pleistocene glaciation features such as u-shaped valleys, arêtes, alpine glacial lakes, thick deposits of ground moraines, and hanging valleys.
- Unglaciated subalpine highlands containing extensive cave and karst formations, including four ice caves. These features are unique to the northern Rocky Mountains.
- Steep sided erosion resistant remnant buttes of the Sioux District provide a stark and dramatic contrast to the adjacent rolling and dissected grassland prairies.
- Exposures of geologic formations known to contain important paleontological resources.
- Additionally, there are specific geologic areas of interest which have been formally designated as notable (table 101).

Caves and Karst Areas

Caves and karst areas represent unique geologic features that contain potentially significant biological, hydrological, mineralogical, scientific, cultural, recreational, and economic resources. Karst topography results from the dissolving action of acidic water on soluble carbonate bedrock units.

The majority of known caves on the Custer Gallatin are solution caves within the Madison Limestone Formation and a lesser amount occur in Cambrian limestone. Other types of caves within the Custer Gallatin include glacier caves, sandstone caves, talus caves, or boulder caves. There are numerous inventoried and un-inventoried caves on the Custer Gallatin National Forest. Inventoried caves have been documented to contain biotic, cultural, mineralogical, paleontological, geologic, hydrologic, and recreation resources. Several areas on the Custer Gallatin can be defined as karst landscapes, most notable amongst these are the Pryor Mountains. Caves in Pleistocene travertine deposits are located on the Gardiner Ranger District.

Table 101. Designated or developed geologic areas of interest

Geologic area of interest	Geographic Area	Description
Capital Rock National Natural Landmark	Sioux	Capital Rock displays uplift and erosion of Late Cretaceous, Paleocene, Oligocene, and Miocene strata within the surrounding prairie environment. The area is a remnant of the once continuous blanket of Tertiary deposits that covered much of the Great Plains.
The Castles National Natural Landmark	Sioux	The Castles consists of steep-walled, flat-topped buttes standing 200 to 400 feet above the surrounding prairie and contains exposed rock of Upper Cretaceous, Paleocene, Oligocene, and Miocene Ages, with a variety of flora and fauna fossils.
Big Ice Cave	Pryor Mountains	Interpretative facilities related to the formation of Ice Caves within the Pryor Mountain cave/karst landscape.
Natural Bridge	Absaroka Beartooth Mountains	Interpretative facilities related to Karst topography; Main Boulder River disappears underground and reappears on cliff face creating dramatic waterfalls.
Bangtail Botanical and Paleontological Special Interest Area	Bridger, Bangtail Crazy Mountains	Occurrence of Tertiary (Eocene) mammalian fossils
Middle Fork Canyon National Natural Landmark	Bridger, Bangtail Crazy Mountains	Middle Fork Canyon illustrates rocks deformed by the earth's tectonic movement. Few places more clearly illustrate the effects of erosion and stream superposition.
Gallatin Petrified Forest	Madison, Henrys Lake, Gallatin Mountains	Widespread occurrence of petrified wood available for public collection via permit. Signed interpretive trail.
Earthquake Lake Geologic Area	Madison, Henrys Lake, Gallatin Mountains	Visitor center and numerous developed interpretive waysides provide interpretation of the 1959 Earthquake.

The Sioux and Ashland Ranger districts have significantly different bedrock geology than the western portions of the Custer Gallatin National Forest and do not contain large masses of carbonate bedrock. No landscapes traditionally considered as “karst” have been identified in these areas, but there are numerous small caves and alcoves formed in sandstone outcrops.

Paleontological Resources

Paleontological resources are broadly synonymous with “fossils,” as defined by Forest Service regulations (36 CFR Part 29). These regulations recognize that all paleontological resources on National Forest System shall be managed by the Secretary of Agriculture using scientific principles and expertise.

Custer Gallatin National Forest lands, particularly the eastern portions, have an abundance of paleontological resources, particularly in the Cretaceous and Tertiary aged formations. The Sioux District contains the largest exposure of Cretaceous Hell Creek Formation on the Custer Gallatin. The Forest Service has been conducting active inventory of paleontological resources on the Sioux District over the last several years. These efforts have resulted in the discovery of numerous vertebrate fossil specimens.

Other portions of the national forest have had paleontological investigations. Areas immediately adjacent to the Pryor Mountains have been explored for the presence of Paleozoic and Mesozoic aged vertebrates. Additionally, caves and traps within the karst topography of the Pryor Mountains have yielded unique Quaternary fossils. The Bangtail Mountains on the Bozeman District have been recognized for the presence of fossils that document Eocene mammalian macroevolution, faunas and flora diversification, and climatic change. The area is also believed to represent unique documentation in the fossil record pertaining to mammalian evolution during the Paleocene epoch. Undiscovered paleontological resources may exist in other portions of the Custer Gallatin. As an example, recently a large fossilized bone was located in the Derby Mountain portion of the Yellowstone District; an area not widely known for fossil occurrences.

Geologic Hazards

Geologic hazards are part of the natural environment of the Custer Gallatin National Forest. Hazards can include unstable landforms such as landslides, rock cliffs or sinkholes. These types of geologic hazards are not generally problems unless associated with forest infrastructure and public recreation areas. Geologic hazards may also consist of naturally occurring minerals and elements, such as erionite, offretite, and uranium, located with bedrock or resultant soils that are naturally a part of the landscape. Actions that disturb these naturally occurring minerals and elements have the potential to create possible human health and safety issues.

Another type of geologic hazard is abandoned and inactive mine sites. A mine site inventory identified 536 possible sites on the Custer Gallatin. This inventory includes both physical public safety hazards and chemical contamination problems at mine sites. The majority of the abandoned/inactive mine sites were associated with the New World Mining District, the Jardine area and Independence. Ongoing inventory has identified additional uranium exploration safety hazards on the Sioux District and the Pryor Mountain area of the Beartooth District.

Several of the abandoned mines fall under the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. 9601 et seq. and 40 CFR part 300 et seq., 1980). This statue provides the authority to clean up where there is a release or a threat of a release of a hazardous substance. Mine sites on the Custer Gallatin that have used this authority for cleanup include the Riley Pass Uranium Mine on the Sioux Ranger District and the New World Mine on the Beartooth and Gardiner Districts.

3.17.3 Environmental Consequences

Effects Common to all Alternatives

The right to access locatable mining operations is a provision of the 1872 mining law. Access to a mining operation on the Custer Gallatin must be reasonable as defined by law and statute. New roads, trails, or other types of access would be approved for a proposed mining operation as long as the proposal is incident to mining and within the scope of the next logical phase of mining development, regardless of any plan component that says no new roads shall be constructed. There would be no new areas that would not allow locatable mineral activities, unless recommended wilderness and wilderness study areas become designated wilderness.

The Hyalite/Porcupine-Buffalo Horn Wilderness Study Area would be managed and regulated according to existing direction. This area would continue not to be available for mineral leasing and salable mineral materials based on the provision in the law requiring this area to be managed to maintain its wilderness character, but is still open to locatable mineral prospecting, exploration, and development.

The congressionally determined boundaries of the Absaroka-Beartooth and Lee Metcalf Wildernesses and the Cabin Creek Recreation and Wildlife Management Area located on the Custer Gallatin National Forest are withdrawn from mineral entry and would be carried forward in all alternatives in the plan. Since direction for wilderness management is detailed in law, regulation, and agency policy and in specific management plans, the effects to congressionally designated wilderness as a result of the revised plan do not differ by alternative.

All inventoried roadless area within the Custer Gallatin were established as a part of the 2001 Roadless Area Conservation Rule and would not change in any of the alternatives. Roadbuilding for leasable and salable mineral development would not be allowed in these areas. However, locatable mineral development is allowable within inventoried roadless areas.

There are many areas across the Custer Gallatin that have been administratively withdrawn from mineral entry, including designated wilderness, campgrounds, ranger stations, work stations, powerline corridors, and trailheads. These areas are not open to mineral entry and, therefore, locatable, leasable and/or salable mineral materials cannot be developed in these areas depending upon the specifics in the withdrawal. The plan does not address existing, pending, or future mineral withdrawal areas. All existing mineral withdrawals are in all alternatives.

Areas where no new road construction would be allowed that are common to all alternatives include designated wilderness, designated wild rivers, Cabin Creek Recreation and Wildlife Management Area, inventoried roadless areas, research natural areas, and the Pryor Mountain Wild Horse Territory.

In all revised plan alternatives, no new road construction would be allowed in recommended wilderness areas, eligible wild rivers, backcountry areas, and low development areas (these allocations vary by alternate).

Areas where no new saleable mineral material extraction would be allowed common to all alternatives include designated wilderness, Cabin Creek Recreation and Wildlife Management Area, research natural areas, Pryor Mountain Wild Horse Territory, national natural landmarks, administrative sites, and developed recreation sites.

Areas where no new saleable mineral material extraction would be allowed include recommended wilderness areas, eligible wild rivers, the Continental Divide National Scenic Trail, backcountry areas, low development areas, riparian management zones, and endemic plant sites in the Pryor Mountains. These areas vary by alternative. In Alternative C, no new saleable mineral material extraction would be allowed in the Hyalite Recreation Emphasis Area.

Current Plans

Management Direction under the Current Plans

The 1986 Custer National Forest Plan contains forestwide and management area direction and extensive standards for the minerals program. Standards discuss specific requirements for the various minerals programs, including cooperation, geophysical exploration, oil and gas leasing, exploration, coal and other leasable minerals, common variety mineral material, locatable minerals, and paleontological resources. An amendment to this forest plan added uniform format for oil and gas leas stipulations, eliminated oil and gas production as a monitoring item and added standards and guides for caves in 1991. In 1996, various changes were made to oil and gas stipulations. In 2007, the Sioux Ranger District Oil and Gas

Leasing Amendment was added to the plan. There is no direction for geologic areas of interest, such as geologic hazards in the 1986 Custer National Forest Plan.

The 1987 Gallatin National Forest Plan provides objectives for locatable, leasable and saleable minerals programs, and mineral withdrawal areas. These objectives state that geothermal development in the Corwin Springs area will be deferred until studies of any effect on Yellowstone National Park are completed. Mineral withdrawal areas were to be reviewed in accordance with the Federal Land Policy and Management Act of 1976. Common variety mineral extractions may only be authorized when compatible with the goals of the management areas. The minerals standards in the plan apply to the locatable, common variety (saleable) and leasable minerals programs and mineral withdrawal areas. Certain management areas within the plan have specific minerals direction. The plan was amended in 1997 to include the Cooke City Minerals Withdrawal. There is no direction for geologic areas of interest, such as caves and karst, paleontological resources, or geologic hazards in the 1987 Gallatin National Forest Plan.

Effects of the Current Plans

Under the current plans, management of the Custer Gallatin would continue under each of the existing Custer and Gallatin forest plans. Additionally, plan components provide for the management of exploration and development of mineral and energy resources as well as geologic areas of interest in a manner consistent with other resource values and management area goals. Although the Gallatin National Forest Plan does not address paleontological and cave resources, they are managed in accordance with existing laws and regulations.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

All revised plan alternatives have the same minerals management direction. Desired conditions envision that the Custer Gallatin is available for mineral and energy resource use, in consideration of other resource values. No plan components eliminate the right to develop locatable minerals, although the standards and guidelines for other resources may affect access for mining, the timing of an operation, and other conditions for operations. Various plan components for certain areas, such as recommended wilderness and backcountry areas, do not allow for the extraction of salable mineral material. Several plan standards protect cave and karst resources.

No new road construction would be allowed in recommended wilderness areas, eligible wild rivers, backcountry areas or low development areas (these allocations vary by alternative).

In alternatives B through E, no new saleable mineral material extraction would be allowed in recommended wilderness areas, eligible wild rivers, the Continental Divide National Scenic Trail, backcountry areas, low development areas, riparian management zones, or endemic plant sites in the Pryor Mountains. In contrast, the current plans do not prohibit new saleable mineral material extraction along the Continental Divide National Scenic Trail, riparian management zones, or endemic plant sites in the Pryor Mountains.

In alternative C, no new saleable mineral material extraction would be allowed in the Hyalite Recreation Emphasis Area.

The Stillwater Complex area is identified as a separate land allocation for specific management direction due to its importance as a significant platinum and palladium deposit. Sibanye Stillwater mining operates two large underground mines and the life of mine is expected to exceed the lifespan of the forest plan. The Stillwater Complex is identified as an area that will be disturbed, both on the surface and subsurface, for the development and production of locatable minerals. The Stillwater Complex management area is not included in alternative D.

Effects of the Revised Plan Alternatives

Stillwater Complex is included in all revised plan alternatives except for alternative D. Since there are no specific plan components to guide mining operations in the Stillwater Complex land allocation differently than other locatable operations on the Custer Gallatin, the effects for the Stillwater mining area are the same for all revised plan alternatives. In alternative D, some of the Stillwater mining area is recommended wilderness area.

The construction of new roads, trails, or other types of access may be approved for a proposed mineral operation, regardless of any plan component that says no new roads shall be constructed. Mineral encumbrances; reserved and outstanding private mineral rights, active and suspended oil and gas leases, and mining claims have the right to access the national forest. Access is given to explore for and develop the minerals, regardless of any plan component that restricts access or road building. Reserved and outstanding private mineral rights may include locatable, saleable, and/or leasable minerals.

Although access is a guaranteed right under the mining laws, the plan component of no new road construction (Cabin Creek Recreation and Wildlife Management Areas, recommended wilderness, Pryor Mountain Wild Horse Territory, Research Natural Areas, backcountry areas, designated, and eligible wild rivers) would likely result in an increase in the length of time to process a minerals plan, additional mitigation requirements and costs for the operations. There would also be an increase in the length of time to process a plan, additional mitigation requirements, and costs for oil and gas activities. There may be an increase in the length of time to process a plan, additional mitigation requirements and costs for a proposal to develop reserved and outstanding minerals.

Table 102 summarizes the acreage where no new roads would be allowed by alternative. The acreage includes land allocations that do not change by alternative, such as designated wilderness areas and inventoried roadless areas, as well as allocations that vary by alternative, such as recommended wilderness.

Table 102. Acres by alternative of lands where new roads are not allowed

Custer Gallatin National Forest	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
All lands with no new roads allowed	1,920,480	1,965,426	1,983,082	2,010,691	1,921,375
Net additional acres above alternative A (existing condition)	0	44,946	62,602	90,211	895

Alternative A represents the current plans' future projections if kept.

Alternative D would have the highest amount of land with the plan direction of no new roads, followed by alternatives C, B, E and the current plans. Alternative D is the highest as a result of the large number of recommended wilderness areas, followed by alternative C which results from the amount of recommended wilderness and backcountry areas. Alternative B has less acreage of recommended wilderness areas and backcountry areas than alternative C. Backcountry areas in alternative E are also inventoried roadless areas and do not result in new areas that restrict new roads. All revised plan alternatives, including alternative E, restrict new roads in eligible wild rivers.

Any plan component that prohibits a new permanent structure would not apply to locatable minerals, oil and gas leases, and reserved and outstanding minerals. Examples of areas with plan components that prohibit new permanent structures, such as utilities or communication sites, are recommended wilderness areas and backcountry areas. Any mining proposal in such area would likely result in an increase in the length of time to process a minerals plan, additional mitigation requirements and costs for the operations.

The Forest Service has the authority to dispose of salable mineral materials through a variety of methods. The disposal of saleable mineral materials is discretionary. Plan components prohibit the extraction and disposal of saleable mineral materials in recommended wilderness areas, backcountry areas, riparian management zones, and the Pryor Mountain Horse area (and in regional endemic and peripheral plant occurrences in the Pryor Mountains). Disposal of saleable mineral materials in the Hyalite Recreation Emphasis area is prohibited in alternative C only. These plan components would reduce the availability of saleable mineral material for projects such as roads, trails and trailheads, campgrounds, and other projects. Material needed for these types of projects may need to be purchased and transported from commercial sources resulting in an increase in the use of fuel and project costs.

Table 103 summarizes the acreage where no saleable mineral material disposals would be allowed by alternative. The acreage includes land allocations that do not change by alternative, such as designated wilderness areas, as well as allocations that vary by alternative, such as recommended wilderness.

Table 103. Acres by alternative of lands where saleable mineral material extractions are not allowed

Custer Gallatin National Forest	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
All lands where saleable Mineral material extraction not allowed	1,225,962	1,566,984	1,768,396	1,965,500	1,503,885
Net additional acres above Alternative A (existing condition)	0	341,022	542,434	739,538	277,923

Alternative A represents the current plans' future projections if kept

Similar to the analysis of the land with the plan direction of no new roads, alternative D would have the highest amount of land that would not allow the extraction of salable mineral material followed by alternatives C, B, E and the current plans. The amount of recommended wilderness areas and backcountry areas in each alternative has the greatest relative effect on the lands where saleable mineral material extraction is not allowed.

Analysis relative to the four mineral rights, which are encumbrances on the land, including reserved and outstanding private mineral rights, active and suspended oil and gas leases, and locatable mining claims is completed in the recommended wilderness section. This analysis shows the various mineral encumbrances on the land for each recommended wilderness area for consideration in the decision process. Although this is a snapshot in time, it gives some indication as to the amount of development that may occur within the recommended wilderness areas. Where backcountry areas have the same boundaries as recommended wilderness areas, impacts would be similar.

Forest Service direction for completing oil and gas leasing environmental analyses and decisions are based on laws, congressional direction, public desire for leases, and available funding. No environmental analysis for oil and gas leasing will be conducted as part of this plan; however, the plan sets the stage for future analysis for leasing. The plan would set the framework for how the Forest Service would blend oil and gas leasing and subsequent development with the sustainable management of the Custer Gallatin.

Leasable minerals management is ongoing on the Custer Gallatin. Large areas of the national forest are leased, but many of these leases are suspended due to a court decision, which required further environmental analysis of the leased land. No activity can take place on the suspended leases until a site-specific environmental impact statement is completed. Other areas of the Custer Gallatin, primarily on the east side have active leases, and drilling and development activities are occurring and future activities may occur on these leases.

Renewable minerals include geothermal, hydropower, solar, and wind energy. Lands on the Custer Gallatin are available for development of renewable resources in consideration of other resource values.

Paleontological resources and geologic hazards are abundant across the Custer Gallatin and plan components would allow for the protection of these resources. The management of geologic areas of interest would be in accordance with the plan components and regulatory direction for each specific resource, such as caves and karst and paleontological resources.

Consequences to Energy, Minerals, and Geologic Areas of Interest from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Watershed, Riparian, and Aquatic Management

The revised plan alternatives provide more detailed guidance than the current plans for protection of watersheds, riparian areas, and aquatic habitats. The revised plan alternatives include the adoption of riparian management zones, which are greater in size from the riparian zones currently identified for streams east of the Continental Divide. Revised plan alternatives direct that new mineral development operations should avoid riparian zones where possible, and minimize adverse effects to aquatic and riparian resources in locations such as woody draws, wetlands, springs, and seeps where these areas cannot be avoided. This plan direction may increase in the length of time to process a minerals plan, additional mitigation requirements and costs for the operations. In the revised plan alternatives, saleable mineral material permits are not to be issued in riparian areas.

Effects from Wildlife Management

In general, wildlife plan components have a moderate impact on minerals and energy management. There may be timing or location restrictions for mineral activities due to wildlife plan components, such as restrictions on energy developments in priority sage-grouse habitat.

Habitat security requirements and other mineral mitigation measures for grizzly bear can be expected to affect locatable, leasable, and salable mineral exploration and development. Where roads, and the access they provide, are necessary, limitations on road construction and operating seasons can be expected to have the effect of prolonging exploration or development work. The developed site standard for grizzly bear could affect a mineral or energy operation by requiring extra mitigation and result is additional costs, if a proposal is within a developed site.

Key linkage areas would limit new permanent facilities. Where mining activities are allowed by valid existing rights or statutory rights in a key linkage area, plan components would result in an increase in the length of time to process a minerals plan and in mitigation requirements and costs for the operations.

Effects from Access and Recreation Management

Saleable mineral material permits are not to be issued within developed recreation sites in all alternatives, nor within the Hyalite Recreation Emphasis area in alternative C.

Effects from Scenery Management

In all alternatives, the forest plan scenic integrity objectives do not outright prohibit on-the-ground actions, but may influence the design or the location of on-the-ground minerals and energy projects that would be visible from any of the listed critical viewing platforms. Design features or mitigations may be required to meet or exceed the assigned scenic integrity objective, which describes the lowest maximum threshold of visual dominance and deviation from the surrounding scenic character. Scenery guidelines allow deviation from the scenic integrity objectives in recognition of valid existing or statutory rights (reserved and outstanding private minerals rights, existing oil and gas leases, and locatable mineral rights.)

The forest plan scenic integrity objectives do not affect geologic resources or geologic hazards as these are natural processes that are part of the natural environment.

Cumulative Effects

If recommended wilderness areas became designated as wilderness by Congress under the Wilderness Act of 1964 and subsequent wilderness legislation, lands would be withdrawn from appropriation under the mining and mineral leasing laws, subject to valid existing rights. Prior to designation as wilderness, mining claims may have been located on public domain lands. Mining operations may continue after designation and will be subject to strict regulation to protect wilderness characteristics. Holders of valid mineral leases retain the rights granted by the terms and conditions of the specific leases. Holders of valid mining claims are allowed to conduct operations necessary for the development, production, and processing of the mineral resource. Mechanical transport, motorized equipment, and access to utility corridors may be used after a determination that they are the minimum necessary. However, these activities and the reclamation of all disturbed lands must minimize the impact on the surrounding wilderness character.

If an eligible wild and scenic river is designated, Federal lands within the boundaries of designated river areas (one-quarter mile from the bank on each side of the river) classified as wild, would be withdrawn from appropriation under the mining and mineral leasing laws by Sections 9(a) and 15(2) of the Wild and Scenic Rivers Act. No new mining claims or mineral leases are allowed for designated river segments classified as wild. Existing valid mining claims or mineral leases within the river boundary would remain in effect, and activities would be allowed, but are subject to regulations that minimize surface disturbance, water sedimentation, pollution, and visual impairment. Reasonable access to mining claims, mineral leases, and other outstanding mineral rights would be permitted.

Federal lands within the boundaries of designated river areas classified as scenic or recreational are not withdrawn under the act from the mining and mineral leasing laws. Therefore, in designated river segments classified as scenic or recreational, location of new mining claims or mineral leases is allowed, but are subject to reasonable access and regulations that minimize surface disturbance, water sedimentation, pollution, and visual impairment.

Adjacent and nearby national forests and Bureau of Land Management lands are available for mineral and energy resource development, but will consider other resources which cumulatively providing for the mineral and energy needs of the nation and the impacts on resources such as water and wildlife.

Conclusion

Plan direction under all alternatives would support continued mineral and energy operations and the management of the areas of geologic interest. Plan components are sufficient to manage the mineral and energy resources and the geology, caves and karst, and paleontology programs.

Plan components in a number of land allocations that would not allow the construction of new roads would likely result in an increase in the length of time to process a plan of operations and in additional mitigation requirements and costs for the operations. These standards would affect the mineral encumbrances on the land, including reserved and outstanding private mineral rights, existing oil and gas leases (both suspended and active) and locatable minerals. Alternative D would have the highest amount of land with the plan component of no new roads, followed by alternatives C, B, E and the current plans.

In the revised plan alternatives, extraction of saleable mineral material would be prohibited in additional areas (primarily recommended wilderness, backcountry areas, and riparian management zones) because it may limit the availability of material for forest and county roads, trails, and other recreational development. Alternative D would have the highest amount of land that would not allow the extraction of salable mineral material followed by alternatives C, B, E and the current plans.

3.18 Infrastructure

3.18.1 Introduction

The infrastructure on the Custer Gallatin National Forest includes roads, trails, bridges, facilities, dams, and proposals for new aircraft landing strips.

Regulatory Framework

Term Permit Act of March 4, 1915 (Pub. L. 63-293, Ch. 144, 38 Stat. 1101, as amended; 16 U.S.C. 497): This act provides direction authorizing occupancy of National Forest System lands for a wide variety of uses through permits not exceeding 30 years.

National Forest Roads and Trails Act of October 13, 1964 (Pub. L. 88-657, 78 Stat. 1089, as amended): This act declares that an adequate system of roads and trails should be constructed and maintained to meet the increasing demand for recreation and other uses. This act authorizes road and trail systems for the national forests. It authorizes granting of easements across National Forest System lands, construction and financing of maximum-economy roads (Forest Service Manual 7705), and imposition of requirements on road users for maintaining and reconstructing roads, including cooperative deposits for that work.

Highway Safety Act of September 9, 1966 (Pub. L. 89-564, 80 Stat. 731, as amended): This act authorizes State and local governments and participating Federal agencies to identify and survey accident locations; to design, construct, and maintain roads in accordance with safety standards; to apply sound traffic control principles and standards; and to promote pedestrian safety. The Highway Safety Improvement Program and the Safety Performance Management Measures Final Rules (effective April 14, 2016) address the requirements of the Moving Ahead for Progress in the 21st Century Act and the Fixing America's Surface Transportation Act. Updates to the existing Highway Safety Improvement Program requirements under 23 CFR 924 are consistent with Moving Ahead for Progress in the 21st Century Act and the Fixing America's Surface Transportation Act, and clarify existing program requirements. The Safety Performance Management Measures Final Rule adds part 490 to title 23 of the Code of Federal Regulations to implement the performance management requirements under 23 U.S.C. 150, including specific safety performance measure requirements for the purpose of carrying out the Highway Safety Improvement Program to assess serious injuries and fatalities on all public roads.

Federal Aid Highway Act of 1968, as amended (23 U.S.C. 109(a) and (h), 144, 151, 319, and 351): This act establishes the National Bridge Inspection Standards (23 CFR 650, Subpart C) and the requirement that each state have a current inventory of bridges on all public roads, including National Forest System roads open to public travel (Forest Service Manual 1535.11).

Surface Transportation Assistance Act of 1978 (Pub. L. 95-599, as amended): This act supersedes the Forest Highway Act of 1958 and authorizes appropriations for Forest highways and public lands highways. Establishes criteria for Forest highways; defines Forest roads, Forest development roads, and Forest development trails (referred to as "National Forest System roads" and "National Forest System trails" in Forest Service regulations and directives); and limits the size of projects performed by Forest Service employees on Forest roads. Establishes the Federal Lands Highway Program.

Secure Rural Schools and Community Self-Determination Act of October 30, 2000 (Pub. L. 106-393, 114 Stat. 1607; 16 U.S.C.500 note): This act provides provisions to make additional investments in, and create additional employment opportunities through, projects that improve the maintenance of existing infrastructure, implement stewardship objectives that enhance Forest ecosystems, and restore and improve land health and water quality.

National Best Management Practices for Water Quality Management on National Forest System Lands, Volume 1: National Core Best Management Practices Technical Guide, April 2012: This is the first volume of guidance for the Forest Service, U.S. Department of Agriculture, and National Best Management Practices Program. The National Best Management Practices Program was developed to improve agency performance and accountability in managing water quality consistent with the Federal Clean Water Act and State water quality programs. Current Forest Service policy directs compliance with required Federal Clean Water Act permits and State regulations and requires the use of the National Best Management Practices Program to control nonpoint source pollution to meet applicable water quality standards and other Federal Clean Water Act requirements. It includes the National Best Management Practices Program for construction, operation, and maintenance of roads and motorized trails.

Moving Ahead for Progress in the 21st-Century Act of July 6, 2012 (Pub. L. 112-141): This act replaces the Federal Lands Highway Program with the Federal Lands Transportation Program and Federal Lands Access Program. This act authorizes funding for Federal lands transportation facilities and Federal lands access transportation facilities under a unified program, with policy similar to Federal-aid highways and other public transportation facilities. It requires Federal land management agencies to identify a comprehensive inventory of public Federal lands transportation facilities that, at a minimum, includes the transportation facilities that provide access to high-use Federal recreation sites or Federal economic generators.

36 CFR 212—Travel Management Final Rule: This rule requires designation of those roads, trails, and areas that are open to motor vehicle use. Designations are made by class of vehicle and, if appropriate, by time of year. This rule prohibits the use of motor vehicles off the designated system, as well as use of motor vehicles on routes and in areas that is not consistent with the designations. Subpart B provides for a system of National Forest System roads, trails, and areas on National Forest System lands designated for motor vehicle use. After these roads, trails, and areas are designated, motor vehicle use, including the class of vehicle and time of year, not in accordance with these designations is prohibited by 36 CFR 261.13. Motor vehicle use off designated roads and trails and outside designated areas is prohibited by 36 CFR 261.13. Subpart C provides for a system of National Forest System roads, trails, and areas on National Forest System lands that are designated for over-snow vehicle use. After these roads, trails, and areas are designated, motorized over-snow vehicle use not in accordance with these designations is prohibited by 36 CFR 261.14. Motorized over-snow vehicle use off designated roads and trails and outside designated areas is prohibited by 36 CFR 261.14.

Forest Service Manual and Handbook 7700 Engineering: This group of manuals and handbooks cover all aspects of roads, facilities, dams, road and trail bridges, and airstrip policy and guidance. Specific sections under this umbrella are highlighted below.

Forest Service Manual 2350 Trail, River, and Similar Recreation Opportunities and Forest Service Handbook 2309.18 Trails Management Handbook: This manual and handbook provides policy and guidance for the trails program.

Forest Service Handbook 7709.58 Transportation System Maintenance Handbook and Forest Service Manual 7700 -Transportation System, Chapter 7730 – Transportation System Operation and Maintenance: This handbook provides road maintenance guidelines.

Forest Service Manual 7730 and 7709 and 23 CFR 650. These provide direction for management of the bridge program and inspection responsibilities and authorities.

Forest Service Handbook 7309.11, section 22. This handbook provides detailed requirements for administrative buildings.

Forest Service Manual 7310: This manual provides direction for the management of buildings and other structures.

Engineering Management (EM) publication, EM-7310-4, Facilities Planning. This is a guide to facilities planning.

Forest Service Manual 7500-Water Storage and Transmission. Forest Service policy for the operations and maintenance of dams.

Key Indicators and Measures

- Amount of land suitable for new recreational aircraft landing strips, measured in acres
- Projected infrastructure maintenance, improvements, and road decommissioning, per plan objectives
- Qualitative assessment of forest plan direction and effects on infrastructure

Methodology and Analysis Process

Effects to infrastructure are qualitatively evaluated by considering effects of forest plan direction on how well it supports and protects infrastructure values and compare the relative level of projected infrastructure maintenance and road decommissioning indicated by the objectives of each alternative. Effects to recreation aviation are quantitatively evaluated comparing the amount of land suitable for new recreational aircraft landing strips.

Information Sources

Existing information used to complete the analysis includes a wide range of documentation including but not limited to INFRA database modules that hold corporate data on infrastructure and spatial information in the geographic information system (GIS) data and feature classes. Historical maintenance and improvement records identify trends. There are also four completed travel management plans used- Beartooth Travel Plan (2008), Ashland Travel Plan (2009), Sioux Travel Plan (2009) and the Gallatin National Forest Travel Management Plan (2006).

Analysis Area

The geographic area for assessing effects to the infrastructure is the Custer Gallatin National Forest and other transportation corridors outside the national forest boundary occupied by important national forest access routes under the jurisdiction of the Forest Service, the counties, and the states. The temporal scope is the expected life of the plan.

3.18.2 Affected Environment (Existing Condition)

Transportation System

The transportation system for the Custer Gallatin National Forest is defined as the system of National Forest System roads, trails, and aircraft landing strips located on National Forest System lands (36 CFR 212.1). The ground transportation system is made up of a network of roads and trails that provide access to and throughout the national forest. The need for the roads and trails within the transportation system is determined through processes outlined in the Final Rule for Travel Management: Designated Routes and Motor Vehicle Use.[18] Implementation of the Travel Management Rule is outlined in Forest Service Manual (FSM) 7700 -Transportation System, Chapter 7730 – Transportation System Operation and Maintenance and in Forest Service Handbook (FSH), 7709.58 Transportation System Maintenance Handbook, and the 2309.18 Trails Management Handbook.

Roads

National Forest System roads are those roads the Forest Service has determined necessary for the protection, administration, and utilization of National Forest System land and the use and development

[18] 36 CFR Parts 212, 251, 261, and 295

of its resources. National Forest System roads are under the jurisdiction of the Forest Service and are located on or provide access to National Forest lands. These roads are a part of a network of an overall transportation system that is managed jointly with other public road agencies such as states, counties and municipalities. This network, when combined, provides access to National Forest System lands. The entire road system is concentrated within approximately 20 percent of the Custer Gallatin National Forest land base. Most were constructed for fire protection, private land access, timber harvest, and range management. A lesser number were constructed for mining, recreational access, water development, and other reasons. Many of the roads were acquired as part of the several major land consolidation projects in the recent past (estimated around 700 miles).

National Forest System roads are designed, constructed, maintained, and operated in support of the Forest Service mission. A road management objective is established for each road as guidance to road managers for implementing objectives of multiple resource programs. Road management objectives are recorded in the corporate Infrastructure database. Road management objectives guide such things as road width, surfacing, road grades, traffic types, maintenance levels, traffic service levels, user comfort, and access management.

The number of roads on the Custer Gallatin National Forest has been determined by the individual travel management plans that have been completed. Each travel management plan determined which roads would be retained for permanent use and which roads were not needed and would be removed from the system. Implementation of the travel management plans is ongoing but is planned to be completed in the next 5 years, depending on the availability of funding. When the travel management plans determined which routes would be retained, they designated the type of traffic allowed, the type of traffic prohibited, and the seasons of each. Only that portion of the road management objective was established by the travel management plans. Other criteria, such as maintenance levels, road widths, surface types, and other factors were not determined by the travel management plans. These are determined by the District Ranger when establishing the road management objectives for each road.

The travel management plans on the Custer Gallatin National Forest fulfilled the requirements of the minimum roads analysis. The travel management plans evaluated each route on the Custer Gallatin and determined if it was needed for the long term or not needed. Since the travel planning process involved extensive public involvement, the minimum roads analysis was also, by default, a public process.

There are approximately 3,070 miles of National Forest System roads on the Custer Gallatin National Forest. Of those, approximately 2,890 miles are in-service (open for highway vehicle use) and 180 miles are out-of-service (closed to all highway vehicle traffic).

There are approximately 1,445 miles of road on the Custer Gallatin National Forest open for public use either seasonally or year-round. Of those miles, approximately 660 miles are operated for passenger car use and 780 miles are operated for high-clearance vehicles. Many of the roads are operated seasonally for the protection of adjacent natural resources and the roadbed itself.

An additional 1,250 miles of road are closed (gated) to public recreational vehicle use. These roads are reserved for administrative use for the protection and use of the national forest and are accessed at the discretion of the district ranger. Approximately 180 miles of road have been temporarily taken out of service and put in storage (generally closed by an earthen berm) for short-term future use.

Finally, there are over 2,000 miles of project roads (see glossary) that have been removed (decommissioned) from the National Forest Transportation System and either restored back to the natural landscape or scheduled for restoration. Of those, an estimated 40 miles of road are scheduled for decommissioning and most are on the Ashland Ranger District. These historic road corridors may be reused in the future for specific project access and implementation.

An unknown number of unauthorized routes exist throughout the Custer Gallatin National Forest, created by users to access firewood, campsites, hunting areas, or for game retrieval. Since these are unauthorized, the routes are slated for removal when identified.

National forest material sources (gravel pits) are scattered throughout the Custer Gallatin National Forest. These are important road features for long-term maintenance of the road system. Many have aggregate or riprap stockpiles for routine maintenance and are kept in operation. Occasionally, Custer Gallatin staff or contractors will enter these pits and extract or crush materials for a road improvement project. Management of weeds in these pits could be improved.

Routine funds that support the management of the road system for all program areas come primarily from an annual appropriation by Congress. These funds fluctuate over the years but have generally been sufficient to cover only custodial road work and have not allowed Custer Gallatin road managers to fully manage the roads to their established road management objectives. The Custer Gallatin staff prioritizes what road work will be addressed each year.

Other funds become available occasionally through congressional initiatives or partnerships. These funds are typically designated toward improvement projects and not maintenance. For example, bridges and culverts are replaced to benefit fish habitat, surfacing is added for erosion control or improved access. The Custer Gallatin routinely pursues these funds and is frequently successful.

Important Roads Adjacent to the Custer Gallatin National Forest

Access to national forest lands is generally provided by a seamless transportation system under the jurisdiction (ownership) of multiple public road agencies. These include Federal highways, such as the Interstate system, state highways, county highways and roads, municipal surface streets, and other Federal road agencies such as the Forest Service or the Bureau of Land Management. At virtually every level, there is some form of cooperation between these road agencies. They share maintenance and improvement schedules, allow guide and destination signing to be placed across they system, and even share in maintenance work where cost efficiencies can be found. A seamless transportation network is critical for the efficient and safe movement of people, goods, and services—particularly emergency services.

Outside of the National Forest System of roads for which the Forest Service has jurisdiction, the Forest Service has identified the “shared-interest” transportation routes that connect the national forest roads to the broader transportation network. These are mostly county roads and State and Federal highways. The mechanism for cooperation with counties is a “Schedule A Agreement.” This agreement identifies the county and national forest roads that comprise the primary access network to the national forest. The maintenance and improvements to this network may be shared by mutual agreement. In most cases, this cooperation provides a more seamless, efficient, and cost effective road system. The cooperation with the highway systems is generally less hands-on than the county systems, but are no less necessary. These agreements generally consist of authorizations for encroachments for road approaches to the highway and directional signing installations within the highway corridor. Without these shared transportation systems, it would be impossible for the Forest Service to access and manage National Forest System lands.

Road Bridges

There are 87 road bridges under the jurisdiction of the Forest Service within the Custer Gallatin National Forest and these are scattered throughout the national forest. The majority of these structures meet or exceed the minimum criteria for bridge condition. Approximately 10 percent of the bridges do not meet the full minimum criteria, but are not in jeopardy to failure at the current time. Forest Service policy requires a two-year inspection cycle on each bridge. This is meant to ensure that issues related to the bridge are identified early and can be efficiently corrected.

Trails

National Forest System trails are managed for the enjoyment, protection, and administration of the national forest. Historically, many of the trails were established for fire protection, including access to fire lookouts. Many more were established for ranger access to the national forest when roads were infrequent and access to range allotments was important. Others were created by forest users accessing mountain attractions. Today most trails are used for recreational access into the national forest.

The trail system was designated by the travel management plans alongside the designation of the road system. Trail corridors were designated for allowed and prohibited uses. The travel management plan for the Gallatin National Forest included nonmotorized uses such as hiking, horseback riding, bicycling, and skiing, and motorized use such as snowmobiling, off-road vehicle riding, motorcycling, 4-wheel driving, and electric bicycling.

National Forest System trails are designed, constructed, maintained, and operated in support of the Forest Service mission. A trail management objective is established for each trail as guidance to trail managers for implementing objectives of multiple resource programs. Trail management objectives are recorded in the corporate Infrastructure database. Trail management objectives guide such things as tread width, surfacing, trail grades, vehicle types, maintenance levels, and access management.

Approximately 3,500 miles of trails are under the jurisdiction of the Forest Service on the Custer Gallatin National Forest. The trails are scattered throughout the national forest and cover most of the land base, including the roaded areas.

Approximately 3,040 miles of trail are operated as summer trails. These are designated for a mix of nonmotorized, mechanized, and motorized trail vehicles. Of those, approximately 1,120 miles are maintained for motorized vehicles and 1,920 miles maintained for nonmotorized users.

Approximately 460 miles of trail are operated as winter trails. Some of these share the same corridor as summer roads and trails. Of those, approximately 340 are maintained for snowmobiles and 120 miles maintained for cross-country skiing.

Routine trail improvement and maintenance funds largely come from congressional appropriations. The Custer Gallatin typically receives around $200 per mile. This has been sufficient to cover custodial maintenance and priority improvements, such as bridge replacements or travel plan implementation projects.

Additional funding also comes from partnerships and congressional initiatives. These funds usually cover prioritized improvement projects, enforcement patrols, and some maintenance.

Trail Bridges

There are approximately 131 trail bridges on the Custer Gallatin National Forest. A trail bridge is generally defined as 20-feet long or longer and over 5-feet high. The Custer Gallatin also has a large number of minor structure not inventoried as trail bridges. Trail bridges are inspected every 5 years for issues. The Custer Gallatin has generally been able to keep up with bridge maintenance, so the bridges are in adequate condition. Most trail bridge issues are the result of installation of an undersized structure hydraulically and foundation erosion threatens to undermine the bridge. Funding for trail bridges comes from the routine trail appropriation.

Facilities

Administrative Facilities

Administrative facilities are typically buildings and their appurtenances necessary to support the employees, equipment, and activities necessary for the management of the national forests. These are commonly called "fire, administrative, and other." Administrative facilities are separate from recreation facilities. Administrative facilities include fire stations, offices, warehouses, and shops, as well as living quarters such as barrack and individual residences. Living quarters are partially supported by rental receipts, while administrative facilities and other facilities are financially supported through annual budget appropriations.

The Custer Gallatin National Forest Headquarters is located in Bozeman, Montana, and is leased from the General Services Administration. There are seven ranger stations located throughout the Custer Gallatin in the following towns – West Yellowstone, Bozeman, Livingston, Gardiner, Red Lodge, Ashland, and Camp Crook (South Dakota). The facilities at Livingston and Bozeman are leased and the other are Forest Service owned. There are leased offices in Billings and Big Timber.

The Custer Gallatin also operates other work centers throughout the national forest that support both fire protection (such as the smokejumper and air tanker base in West Yellowstone and the helicopter Base near Bozeman) as well as other resource programs.

The current administrative facilities inventory lists 199 Forest Service-owned buildings. These range from larger offices, warehouses, bunkhouses, residences, and garages to smaller outbuildings. Each of these buildings is supported by a mix of water and wastewater systems, access roads, parking, fencing, and other structures.

Administrative facilities are routinely inspected for maintenance issues. The Custer Gallatin has sufficient resources to keep up with the routine maintenance but is falling behind in major replacements and repairs. Additional resources would be needed to keep the facilities infrastructure in acceptable operating condition.

Recreation Facilities

Recreation facilities are buildings, cabins, water, and wastewater systems that are operated and maintained specifically to support public recreational use. These recreation facilities are often located at developed recreation sites, such as campgrounds, day use areas, and interpretive sites, where recreation use requires a management investment to operate or maintain the site to health and safety standards.

The inventory of developed recreation sites and recreational structures is held in the INFRA database. Condition surveys are completed on every structure and within every developed recreation sites on a 5-year cycle, and are recorded in the INFRA database.

These sites range in size and category from developed campgrounds and picnic areas, to small interpretive sites with signs and interpretation. These developed sites may contain site features such as signs, tables, fire rings, and parking barriers.

Larger infrastructure elements such as toilet buildings, picnic shelters, cabins, lookouts, and water and wastewater systems are also located within these developed recreation sites. There are 427 buildings classified as recreation facilities across the planning area. There are 35 buildings used for cabin rentals. In addition, there are 324 toilet buildings, primarily located within developed recreation sites Spread across the Custer Gallatin are another 68 buildings such as picnic shelters, barns, and pump houses. Finally, the Custer Gallatin National Forest also maintains 82 water systems and 36 waste water systems across the planning area.

Dams

There are six Forest Service owned dams in the Custer Gallatin National Forest and are all located in the eastern ranger districts. These are all small earthen dams created years ago using local materials. They were originally constructed as water storage in dry areas for the stock management program. Their purpose has evolved into wildlife and recreational values as well as the stock program.

These dams are routinely inspected for issues. In recent years, funds have been available to correct minor issues. The dams are in acceptable condition but since they were built under past standards, they could be vulnerable to extreme weather events.

Other privately owned dams are located on the Custer Gallatin and are under special use permits. They are not discussed in this section.

Aircraft Landing Strips

The Custer Gallatin National Forest does not manage any public or administrative airfields as part of the transportation system. The Forest Service owns taxiways and tarmacs at the West Yellowstone Airport in support of the smokejumper and air tanker base. There are no existing public or administrative aircraft landing strips on national forest lands.

General Infrastructure Condition

Much of the infrastructure on the Custer Gallatin National Forest was constructed decades in the past and could use repair and heavy maintenance. As a rule, the Custer Gallatin has been able to keep up the critical health, safety, and condition issues. In some cases the Forest Service has made important steps forward where there have been congressional initiatives to support the work. These initiatives, as a rule, have been infrequent and insufficient, although a positive step forward in reducing the overall backlog of maintenance. The Custer Gallatin continues to deal with emergency unforeseen issues due to outdated infrastructure nearing or past its service life. This applies to all the infrastructure: roads, trails, dams, and facilities.

3.18.3 Environmental Consequences

Current Plans

Management Direction under the Current Plans

The 1986 Custer National Forest Plan and the 1987 Gallatin National Forest Plan both describe forestwide and management area-specific goals, objectives, and standards related to management of a variety of resource values found within the respective planning areas, including facilities.

The Gallatin National Forest Plan was amended during the transportation planning effort. All transportation management was removed from the forest plan and incorporated into the travel management decision. Dam direction states that applications for hydropower, water diversion, water storage, or other water-related facilities will be evaluated on a case-by-case basis and coordinated with other agencies when appropriate.

The Custer National Forest Plan was amended and road-specific information for the Beartooth District was removed and incorporated into the Beartooth Travel Management Decision. The Sioux and Ashland Districts did not have road-specific management direction in the current forest plan. Facilities such as buildings are addressed in Management Area P, with direction such as interpretive facilities may be used at these sites, specifically that hunter camps are permitted at the Meyers Creek Station, grazing may be used to achieve other resource objectives, these areas are not part of the suitable timber base but harvest may be used for other reasons. Other infrastructure direction states that dams constructed on National Forest System lands shall be designed, constructed, and maintained to standards ensuring safe and satisfactory performance. The Federal Guidelines for Dam Safety (National Dam Inspection Act of 1972) shall be followed.

The Gallatin National Forest Plan has specific direction in Management Area 1 for areas including all developed recreation sites such as campgrounds, picnic areas, boat ramps, visitor information sites, airstrips, recreation residence tracts, and recreation rental cabins, as amended. Goals are to maintain these sites and facilities and there is direction that recreation activity scheduling will identify where construction, modification, or closure will take place and which areas are unsuitable for timber production. Other direction is to maintain these sites and facilities for the safety and enjoyment of users and provide additional facilities where analysis shows the need. Livestock grazing is restricted to meet management area goals and keep individual camping units away from shorelines.

Gallatin National Forest Plan Management Area 26 addresses ranger stations, work centers and other administrative sites with a goal to provide and maintain sites and facilities necessary for the administration of Gallatin National Forest lands. It states that these sites are not managed specifically for recreation, but sites not seasonally needed for administration may be made available for rentals to the public. Administrative cabins in wilderness will not be rented to the public. Livestock grazing may be allowed where compatible with the management area goal and the locations are classified as unsuitable for timber production.

Neither the Custer nor Gallatin forest plans currently address aircraft landing strips, as there are none other than the smokejumper base. However, the Gallatin Travel Plan Record of Decision prohibited public recreational aircraft landing and takeoff except at designated and authorized sites, and precluded consideration of potential sites in designated wilderness, the wilderness study area, recommended wilderness, and within the Grizzly Bear Recovery Zone.

Effects of Current Plans

Under the current plans, the four travel plans remain in effect for the Custer Gallatin National Forest. Road, bridge, trail, dam and facility maintenance (both recurrent and deferred) would continue to occur, as funding allows. Physical conditions would continue to be addressed through maintenance activities and be based on public health and safety, resource protection, and mission priorities. Annual operating budgets and supplemental funding would likely fluctuate, resulting in varying maintenance accomplishments from year to year. Maintenance funding for trail bridges and structures comes from within the trails budget. As those budgets flex, so does the ability to properly maintain trail bridges and structures. Bridge issues would get priority attention since they carry higher risk in evaluating the safety of users.

There are no current proposals pending to build new recreation or administrative facilities or dams. Trail and road bridge construction would be likely as a normal course of maintenance. Roads would likely be constructed or reconstructed as part of the vegetation management program. Trails would continue to be constructed or reconstructed as part of the travel management plan implementation and resolution of user or resource issues or increases in demand.

In the current plans, all 40 miles of road that are programmed to be decommissioned, primarily on the Ashland District, would be decommissioned over the life of the plan.

About 34 percent of the Custer Gallatin National Forest is suitable for new recreational aircraft landing strips in the current plans. Table 104 displays acres where new recreational aircraft landing strips are suitable by geographic area.

Table 104. Acres suitable for new aircraft landing strips under the current plans

Geographic Area	Acres
Sioux	163,269
Ashland	402,557
Pryor Mountains	49,489
Absaroka Beartooth Mountains	171,971
Bridger, Bangtail, Crazy Mountains	98,040
Madison, Henrys Lake, Gallatin Mountains	136,324
Total	1,021,650

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

Plan components for roads and trails, facilities and dams do not vary between the alternatives. Design standards for new infrastructure would vary by alternative recreation opportunity spectrum classes. For instance, a trail bridge may be built using different materials in a primitive setting compared to a semi-primitive motorized setting.

Desired conditions envision a safe and effective transportation system, connected to roads of other jurisdictions, with minimal impacts on natural and cultural resources. Facilities and dams support the Forest Service mission. Standards and guidelines protect aquatic, riparian and other resources. Objectives outline road, trail and facility maintenance levels, and miles of roads to be decommissioned.

Objectives for road, trail and facility maintenance would be similar in alternatives A, B and C. Projected road and trail maintenance would be lower in alternative D than alternatives A, B and C because natural resource restoration would be emphasized in this alternative. Projected facility and road maintenance would be lower in alternative E than alternatives A, B and C and road maintenance would emphasize roads needed for timber access because the budget demands of a higher timber volume result in less funding for infrastructure maintenance. About 40 miles of road would be decommissioned, primarily in the Ashland Geographic Area.

Locations where new aircraft landing strips would be suitable vary by alternative. The use would not be suitable in alternative D. In alternatives B, C, and E the draft forest plan states:

> Backcountry aircraft landing strips are not suitable in designated wilderness, the Hyalite Porcupine Buffalo Horn Wilderness Study Area, the Cabin Creek Recreation Wildlife Management Area, National Natural Landmarks, the Wild Horse Territory, research natural areas, special areas, recommended wilderness areas, within ¼ mile each side of eligible wild rivers, within ½ mile each side of the Continental Divide Trail, riparian management zones, areas of primitive or semi-primitive non-motorized recreation opportunity spectrum, or within the Grizzly Bear Recovery Zone. Backcountry aircraft landing strips are suitable in areas of rural, roaded natural and semi-primitive motorized recreation opportunity spectrum, outside of the designated areas listed in the preceding sentence.

Effects of the Revised Plan Alternatives

Similar to the current plans, road, bridge, trail, dams and facility maintenance (both recurrent and deferred) would continue to occur, as funding allows for alternatives B through E. Physical conditions would continue to be addressed through maintenance activities and be based on public health and safety, resource protection, and mission priorities. Annual operating budgets and supplemental funding would likely fluctuate, resulting in varying maintenance accomplishments from year to year.

The projected amount of road, trail and facility maintenance would be similar in alternatives A, B and C and lower in both alternatives D and. E. The lower maintenance levels in alternatives D and E could lead to deteriorating physical condition of infrastructure, resource impacts and impacts to the visitor’s experience.

The Custer Gallatin National Forest would continue to implement the four travel plans. If the selected alternative calls for change in motorized or mechanized trails use, the applicable travel plans would be updated after completion of the forest plan revision process.

Under alternatives B through E, the Custer Gallatin National Forest expects to maintain an appropriately sized and environmentally sustainable road system that is responsive to ecological, economic, and social concerns. The national forest road system of the future would continue to provide access for recreation and resource management, as well as support watershed restoration and resource protection to sustain healthy ecosystems.

Table 105 displays acres where new recreational aircraft landing strips would be suitable by alternative. In alternatives B, C and E, about 30 percent of the Custer Gallatin would be suitable for aircraft landing strips. Aircraft landing strips would be not suitable in alternative D anywhere on the national forest. Those seeking this type of recreation opportunity would have to visit other destinations off the national forest. Within these areas, only a limited number of sites would meet the criteria for a landing strip. The appropriate landing strip length and width, glide paths, sideslopes, wind variability, difficulty of construction and maintenance would have to be taken into consideration.

Table 105. Acres suitable for new aircraft landing strips in the revised plan alternatives

Geographic Area	Alternative B	Alternative C	Alternative D	Alternative E
Sioux	146,116	146,116	0	146,116
Ashland	386,487	373,587	0	386,487
Pryor Mountains	44,149	29,587	0	44,347
Absaroka Beartooth Mountains	154,782	154,782	0	155,181
Bridger, Bangtail, Crazy Mountains	87,001	87,001	0	87,182
Madison, Henrys Lake, Gallatin Mountains	118,775	116,226	0	119,278
Total	937,310	907,300	0	938,591

Consequences to Infrastructure from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Watershed, Riparian, and Aquatic Management

Alternatives B through E provide more detailed guidance than the current plans for protection of watersheds, riparian areas and aquatic habitats. The alternatives include the adoption of riparian management zones, which are greater in size from the riparian zones currently identified for streams east of the Continental Divide. Installation of drainage features would increase the stability of the road and reduce its deterioration for long-term storage. Repairing stream crossings would protect the road and avoid future road failure during high water event. Due to limited funding allocations for road maintenance, prioritizing road maintenance and obliteration to travel routes that directly affect streams verses roads that are ecologically disconnected from streams, may result in roads with higher public use not receiving road maintenance, reducing their drivability.

Avoiding construction of roads in riparian management zones may limit new access or increase cost of construction. Requiring all new, reconstructed and replaced crossings to meet the 100-year flow event would increase the cost and limit the number completed each year but provide increased road protection during high water events. Installation of drainage features would increase the stability of the road and reduce its deterioration for long-term storage. Desired conditions would ensure that bridges and culverts are managed to provide safe access while protecting natural and cultural resources, and provide for aquatic organism passage. In all alternatives, not locating roads on lands with high mass wasting potential or wetlands and unsuitable areas would increase the stability and longevity of the road but may result in increased construction costs to avoid those areas.

Additional material sources (gravel pits) would likely be needed throughout the Custer Gallatin National Forest to provide weed-controlled aggregate and riprap for the required road and crossing improvements. In all alternatives, extraction of saleable mineral materials would not be allowed in certain land allocations. Alternative D would have the highest acreage where saleable mineral materials would not be allowed, followed by alternatives, C, D, E and then A (the current plans). See the Energy and Mineral section of this document for details.

If the result of climate change is larger more erratic storms, higher flash flooding events, and more forest drying and fires, the road and trail systems will have to adapt. Where streams are close to roads and trails, they would have to be moved or armored to protect the transportation investment. Large flood events in the last three decades on the Custer Gallatin have given a glimpse on what could happen in the future if these event are as or more powerful and frequent as those past events.

Effects from Fire and Fuels Management

Fuels management activities (such as prescribed burning) and fire suppression actions have plan direction to protect constructed facilities.

Effects from Wildlife Management

Those facilities that are within areas of wildlife plan direction (for the grizzly bear in particular) will operate to reduce potential for conflicts. Key linkage areas would restrict future developed recreation facilities, trails and new roads. New recreation facilities, roads, fences, campgrounds, picnic areas, etc. should not be constructed in priority or general sage-grouse habitat unless the development results in a net conservation gain to the species and its habitat.

Effects from Weed Management

As weed issues continue to increase on National Forest System roads and trails, additional restrictions to road and trail maintenance will be likely. For instance, road blading may be restricted to dates outside of when seed heads could fracture and spread for differing species, or blading methods would adapt to reduce seed spread. Additional machinery cleaning intervals may be required to reduce spread of individual species within the national forest. Plan objectives for weed control are lowest in alternative E, followed by alternatives A, B, and C. Alternative D proposes the highest amount of weed treatment.

Effects from Timber Management

Timber harvest activities would generally result in road reconstruction, maintenance, and continued application of best management practices on existing National Forest System roads. Additional road construction would be likely to access new harvest areas, assuming conventional logging systems are used. Temporary roads would be used when a single access is anticipated and restored following the project. Permanent system roads would be considered where multiple projects in the area are contemplated. These roads may either be put into storage or gated and left in service. In either case, the roads would remain as administrative roads and not be open to public vehicle use, unless amended by the travel management plan.

Bridge load ratings are required for all road bridges on timber haul routes. When bridges are expected to carry over-sized and over-weight machinery, either an overload permit or bridge improvements would be required. Alternative E has the highest projected timber volume, and therefore has the highest potential for new roads associated with timber harvest, followed by alternatives A, B and C, and finally alternative D.

Timber projects bring additional maintenance to the haul roads, benefiting the recreational traffic with better maintained roads and allowing the offset appropriated funds to be moved to other critical maintenance needs. In alternative E, the limited funds for high-clearance road maintenance would be prioritized for access for timber harvest in keeping with the theme of this alternative.

Effects from Recreation Management

As recreational demands increase over time, the road and trail system operation and maintenance will have to adapt. The demand for additional road maintenance, roadbed improvements, destination guidance, additional parking, and other responses would be expected by the users. The existing road system is primarily single lane with periodic turnouts for passing. These single lane roads have a finite carrying capacity. As use increases, some popular roads will exceed that capacity and will need to be converted to double lane roads with a corresponding change in driving surfaces. The need for paved roads to handle the traffic will have to be considered. Differing speed limits may have to be considered to slow down or speed up traffic.

Winter plowing of roads and parking lots will likely increase as recreational demands go up. Climate change (warming) will affect the winter recreation program. As shoulder seasons get warmer, low elevations and south aspects drier, and snow packs more inconsistent, the road and trail systems will have to adjust. Parking lots may have to move up-drainage to “chase” the snow levels, grooming extents and schedules will have to change, dry areas may be more prevalent, roads may require less plowing, and maybe even a reconsideration of designated winter recreation area reevaluated. During the 1990s drought, low snow levels in the Hebgen Basin required snowmobile managers to install cautionary information for increased hazards such as dry spots, exposed stumps and logs, collapsed snow bridges across creeks, and poor snow conditions. The effects of that drought are likely similar to future climate change effects.

Operation of trails accessing or within recommended wilderness areas would be affected. Motorized trails would be converted to nonmotorized trails. Future maintenance and improvements those trails would adapt to the changing uses, such as narrowing treads, removal of unneeded bridges, adding vehicle restriction devices, and other actions. The travel management plans would have to be amended. The applicable travel plans would need to be updated after completion of the forest plan revision process. Maps and inventories would have to be updated.

Closing areas to motorized and mechanized trail uses would result in additional concentration of use in areas remaining open. The concentrated areas would require additional maintenance and improvements as the trails would likely carry more use. Changes in trail use would be highest under alternative D, followed by alternative C. No changes in trail use are proposed for alternatives A, B or E.

Effects from Scenery Management

The forest plan scenic integrity objectives do not outright prohibit on-the-ground actions, but may influence the design or the location of on-the-ground infrastructure projects that would be visible from any of the listed critical viewing platforms. Design features or mitigations may be required to meet or exceed the assigned scenic integrity objective, which describes the lowest maximum threshold of visual dominance and deviation from the surrounding scenic character.

Cumulative Effects

Public use on the Custer Gallatin National Forest is increasing, as is the population of Montana, specifically in Billings and Bozeman, two of the larger cities in Montana. There is a greater demand for services as well as greater degradation of the road system from the increased use and additional maintenance and improvements would be required. This trend is expected to continue. There will continue to be a need to provide access for multiple uses including mining, timber, grazing and recreation.

Conclusion

In alternatives A, B, C and E, between about 30 percent and 34 percent of the Custer Gallatin National Forest would be suitable for recreational aircraft landing strips. This use would not be permitted in alternative D.

Strengthened plan components for watershed, riparian, and aquatic resources in the revised plan alternatives would require increased improvements on roads and trails near streams.

Additional roads would potentially be constructed to access timber within the suitable base. In general, single short-term entries would construct temporary road systems while multiple long-term entries would construct long-lasting system roads.

Expanding recreational demand would require road and trail managers to consider traffic volume improvements such as route widening and surfacing while increasing routine maintenance.

Climate changes would require added stormproofing of the road and trail systems. Climate change would also lead winter trail managers into reevaluating winter trails in low elevations and south aspects, and within shoulder seasons. Winter parking locations would have to adjust along with the designated winter trail system.

The projected amount of road, trail and facility maintenance would be similar in alternatives A, B and C and lower in both alternatives D and. E. The lower maintenance levels in alternatives D and E could lead to deteriorating physical condition of infrastructure, resource impacts and impacts to the visitor’s experience. Maintenance funding would be prioritized for the most heavily used routes, at the expense of less used routes.

About 40 miles of road would be decommissioned in all alternatives, primarily in the Ashland Geographic Area. This is the continued implementation of the travel management plans to remove unneeded roads.

Closing areas to motorized and mechanized trail uses would result in additional concentration of use in areas remaining open thus increasing pressures on the open infrastructure. Changes in trail use would be highest under alternative D, followed by alternative C. No changes in trail use are proposed for alternatives A, B or E.

New plan components would provide for a safe and effective transportation system, connected to roads of other jurisdictions, with minimal impacts on natural and cultural resources. Facilities and dams would support the Forest Service mission.

3.19 Recreation Settings, Opportunities, and Access

3.19.1 Introduction

The focus of outdoor recreation management is to provide a range of environmentally sustainable opportunities in natural settings in order to meet the needs and desires of visitors. Recreation settings are the social, managerial, and physical attributes of a place that, when combined, provide a distinct set of recreation opportunities. Sustainable recreation is defined as the set of recreation settings and opportunities on the national forest that are ecologically, economically, and socially sustainable for present and future generations.

The Forest Service often categorizes recreational activities into two descriptions, developed recreation and dispersed recreation. Both types of recreation are categorized further by the recreation opportunity spectrum. Much of the discussion to follow will use recreation opportunity spectrum to explain components for dispersed recreation in particular.

Developed recreation occurs in settings that have been created or constructed for specific recreational purposes on the national forest, such as overnight campgrounds, picnic sites, downhill ski areas, rental cabins, boat docks, visitor centers, interpretive trails with display panels, organizational camps, and special use permitted recreation residence tracts. Fees may or may not be charged. Some are operated under permit by private enterprises. These locations are usually given site names, inventoried, and categorized in forests' databases with basic capacity information and design features.

Dispersed recreation typically happens across the entire forest without infrastructure beyond trails. Hiking, bird watching, driving for pleasure, rock and ice climbing, boating, hunting, fishing, berry picking, backcountry skiing, horseback riding, and motorized and mechanized trail use. "Dispersed camping" means campers select their own areas to camp and they are without provided facilities. There may be a left over rock fire ring from previous campers, but the agency does not specifically manage that area just for recreation. These areas are sometimes called frontcountry, to others it is just, "the woods."

Recreation special use permits are issued to private businesses, individuals, institutions, other government entities and nonprofit groups to provide for occupancy and use of the national forests beyond what is normally available to the public.

Regulatory Framework

Organic Administration Act of June 4, 1897 (30 Stat. 11, as amended): authorizes the establishment of national forests.

Term Permit Act of March 4, 1915 (Pub. L. 63-293, Ch. 144, 38 Stat. 1101, as amended; 16 U.S.C. 497): provides direction to the National Forest System lands to authorize occupancy for a wide variety of uses through permits not exceeding 30 years.

Multiple-Use Sustained-Yield Act of June 12, 1960 (Pub. L.86-517, 74 Stat. 215): provides direction to the National Forest System lands to provide access and recreation opportunities. The act states, "The policy of Congress is that national forests are established and administered for outdoor recreation…"

National Forest Roads and Trails Act of October 13, 1964 (Pub. L. 88-657, 78 Stat. 1089, as amended): declares that an adequate system of roads and trails should be constructed and maintained to meet the increasing demand for recreation and other uses. The act authorizes road and trail systems for the national forests. It authorizes granting of easements across National Forest System lands, construction and financing of maximum-economy roads (Forest Service Manual 7705), and imposition of requirements on road users for maintaining and reconstructing roads, including cooperative deposits for that work.

Land and Water Conservation Fund Act of 1965 (Pub. L. 88-578, 78 Stat. 897 as amended; 16 U.S.C. 460l-4604 (note); 460l-4604 through 6a, 460l-4607 through 460l-4610, 460l-4610a-d, 460l-4611): "The purposes of this act are to assist in preserving, developing, and assuring accessibility to all citizens of the United States of America . . . [to] such quality and quantity of outdoor recreation resources . . . [and] providing funds" to States for acquisition, planning, and development of recreation facilities and Federal agencies for acquisition and development of certain lands and other areas.

Architectural Barriers Act of August 12, 1968 (Pub. L. 90-480, 82 Stat. 718 51 U.S.C. 4151-4154, 4154a, 4155-4157): establishes additional requirements to ensure that buildings, facilities, rail passenger cars, and vehicles are accessible to individuals with disabilities. It covers architecture and design, transportation, and communication elements of recreational site planning and development.

National Trails System Act of October 2, 1968 (Pub. L. 90-543, 82 Stat. 919, as amended): establishes the National Trails System and authorizes planning, right-of-way acquisition, and construction of trails established by Congress or the secretary of agriculture.

Rehabilitation Act of September 26, 1973 (Pub. L. 93-112, Title V, 87 Stat. 390, as amended; 29 U.S.C. 791, 793-794, 794a, 794b): requires that programs and activities conducted by Federal agencies and by entities that receive funding from, or operate under a permit from, Federal agencies provide an equal opportunity for individuals with disabilities to participate in an integrated setting, as independently as possible. The only exception to the requirement is when the program would be fundamentally altered if changes were made solely for the purpose of accessibility.

Forest and Rangeland Renewable Resources Planning Act of August 17, 1974 (Pub. L. 93-378, 88 Stat. 476, as amended): declares (per Sec. 10) that "the installation of a proper system of transportation to service the National Forest System… shall be carried forward in time to meet anticipated needs on an economical and environmentally sound basis."

Federal Land Policy and Management Act of October 21, 1976 (Pub. L. 94-579, 90 Stat. 2742, as amended): declares (per Sec. 102) that "the public lands be managed in a manner that… will provide for outdoor recreation and human occupancy and use."

Omnibus Parks and Public Lands Management Act of November 12, 1996 (Pub. L. 104-333, Div. I, Title VII, Sec. 701, 110 Stat. 4182; 16 U.S.C. 497c): Section 701 of this act:

- establishes a system to calculate fees for ski area permits issued under the National Forest Ski Area Permit Act of 1986 (16 U.S.C. 497b);
- provides for holders of ski area permits issued under other authorities to elect this permit fee system (Forest Service Handbook 2709.11, sec. 38.03a);

- includes provisions concerning compliance with the National Environmental Policy Act when issuing permits for existing ski areas (Forest Service Manual 2721.61f and Forest Service Handbook 2709.11, sec. 41.61b); and
- withdraws leasable and locatable minerals, subject to valid existing rights (Forest Service Handbook 2709.11, sec. 41.61c).

Secure Rural Schools and Community Self-Determination Act of October 30, 2000 (Pub. L. 106-393, 114 Stat. 1607; 16 U.S.C.500 note): provides provisions to make additional investments in, and create additional employment opportunities through, projects that improve the maintenance of existing infrastructure; implement stewardship objectives that enhance forest ecosystems; and restore and improve land health and water quality.

Federal Lands Recreation Enhancement Act of December 8, 2004 (Pub. L. 108-447, as amended): gives the secretaries of agriculture and interior the authority to establish, modify, charge, and collect recreation fees at Federal recreational lands where a certain level of amenities have been developed.

The Federal Cave Resources Protection Act of 1988 (Pub. L. 101-691): aims to "secure, protect, and preserve significant caves on Federal lands for the perpetual use, enjoyment, and benefit of all people; and to foster increased cooperation and exchange of information between governmental authorities and those who utilize caves located on Federal lands for scientific, education, or recreational purposes." Specific effects of the act include prohibiting the disclosure of location of significant caves, the removal of cave resources, and vandalizing or disturbing cave resources.

Executive Order 12862, Setting Customer Service Standards: requires information about the quantity and quality of recreation visits for national forest plans.

Executive Order 11644, as amended: establishes policy and procedure "that will ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of those lands, to promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands."

Executive Order 13443, Facilitation of Hunting Heritage and Wildlife Conservation: directs Federal agencies to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.

Key Indicators and Measures

Effects to recreation opportunity spectrum settings are measured by determining the acres and percentage of desired summer and winter settings by alternative. The desired recreation opportunity spectrum varies by alternatives in concert with land allocations. The differences between alternatives are qualitatively evaluated by considering effects of forest plan direction and how well it supports and benefits people for developed, dispersed, and recreational special use permits.

Methodology and Analysis Process

The desired recreation opportunity spectrum for summer and winter was mapped across the Custer Gallatin for each alternative. The methodology for this mapping follows Forest Service handbook direction. Each alternative was then analyzed for the total number of acres and percentage of the desired recreation opportunity spectrum settings on the Custer Gallatin.

Developed recreation sites were mapped, either as point data or if available as a polygon. Dispersed recreation sites were inventoried over recent years and mapped as point data. The assumption is that not all dispersed sites were mapped, as new ones can develop quickly.

Recreation information is presented at two geographic scales: forestwide and by geographic area. The forestwide scale provides information on relevant Forest Service process and policy and overall direction for recreation. Recreation information by geographic area is more detailed and allows a reader interested in a specific area to find more area-specific information (if it is different from forestwide direction).

Since adoption of the 1986 and 1987 forest plans, recreation activities within the Custer Gallatin have changed. This analysis assumes that changes to recreational use patterns would occur naturally as a result of factors associated with recreation trends, advances in technology, aging population, aging infrastructure, local population increase and decreases, and climatic changes.

The forest plan establishes programmatic level direction. It does not make site-specific travel planning designations, maintenance level determinations, operational choices, or project level decisions. The forest plan sets broad level context for sustainable recreation and trails management across the vast Custer Gallatin National Forest landscape. If higher level land management allocations result in inconsistencies with travel planning direction, subsequent travel plan amendments or modification may be necessary. In addition to the laws and executive orders listed in the introduction, the Forest Service Manual provides nation-wide and regional direction on recreation management topics. Those policies are not repeated in forest plans.

Information Sources

The Custer Gallatin used the best available data relevant to inform the analysis for the new forest plan components for recreation settings, recreation opportunities, recreation special uses, and recreation access. Data sources included the latest information from the National Visitor Use Monitoring (NVUM) project. Much of the recreation data used in this analysis comes from the Forest Service infrastructure database (INFRA). This Forest-level database is a collection of web-based data entry forms, reporting tools, and mapping tools (a geographic information system that enables forests' to manage and report accurate information about their inventory of constructed features and land units). Use of the geographic information system allows forest staff to visualize, analyze, interpret, and understand data to reveal relationships and patterns. Site-specific knowledge from forest personnel is also used. The Forest Service uses the special-uses data system to create and administer special-use authorizations. This data is supported by hardcopy files held at the ranger district and forest supervisor's offices.

Analysis Area

The geographic scope of the analysis is the lands administered by the Custer Gallatin National Forest. All lands within the national forest boundary form the geographic scope for cumulative effects, and the temporal scope is the life of the plan.

3.19.2 Recreation Opportunity Spectrum Affected Environment (Existing Condition)

Sustainable recreation settings are the social, managerial, and physical attributes of a place that, when combined, provide a distinct set of recreation opportunities. Sustainable recreation settings and opportunities are affected by trends in recreation uses and the mix of outdoor activities chosen by the public, which continuously evolve. Recreation activities on the Custer Gallatin National Forest include, but are not limited to, cross-country and downhill skiing, snowboarding, snowmobiling, dog sledding, hiking, backpacking, horseback riding, mountain biking, camping, hunting, fishing, off-highway vehicle driving or riding, picnicking, swimming, boating, paddle boarding, recreation aviation, wildlife watching, visiting historic sites or scenic areas, participating in interpretive programs or tours, and resort use. The Forest Service utilizes a framework called the recreation opportunity spectrum, which describes different settings across the landscape and attributes associated with those settings. Table 106 defines the recreation opportunity spectrum. Five of the six of the recreation opportunity spectrum classes are found within the Custer Gallatin National Forest; no lands in the urban category are present on the Custer Gallatin.

Table 106. Recreation opportunity spectrum classes and definitions

Recreation Opportunity Spectrum Class	Definition
Primitive	Large, remote, wild, and predominately unmodified landscapes. Areas with no motorized activity and little probability of seeing other people.
Semi-Primitive Nonmotorized	Areas of the forests managed for nonmotorized use. Uses include hiking and equestrian trails, mountain bikes and other nonmotorized mechanized equipment. Rustic facilities and opportunity for exploration, challenge, and self-reliance.
Semi-Primitive Motorized	Backcountry areas used primarily by motorized users on designated routes. Roads and trails designed for off-highway vehicles and high-clearance vehicles. Offers motorized opportunities for exploration, challenge, and self-reliance. Rustic facilities. Often provide portals into adjacent primitive or semi-primitive nonmotorized areas.
Roaded Natural	Often referred to as front country recreation areas, these areas are accessed by open system roads that can accommodate sedan travel. Facilities are less rustic and more developed with campgrounds, trailheads and airstrips often present. Provide access points for adjacent semi-primitive motorized, semi-primitive nonmotorized, and primitive settings.
Rural	Highly developed recreation sites and modified natural settings. Easily accessed by major highways. Located within populated areas where private land and other land holdings are nearby and obvious. Facilities are designed for user comfort and convenience.
Urban	Areas with highly developed recreation sites and extensively modified natural settings. Often located adjacent to or within cities or high population areas. High probability of seeing large groups of people and opportunities for solitude or silence are few.

3.19.3 Recreation Opportunity Spectrum Environmental Consequences

Table 107 and table 108 describes the percent of each desired recreation opportunity spectrum by alternative for summer and for winter, respectively.

Table 107. Percentages of summer recreation opportunity spectrum classes on the Custer Gallatin National Forest by alternative

Alternative	Primitive percent	Semi-Primitive Nonmotorized percent	Semi-Primitive Motorized percent	Roaded Natural percent	Rural percent
A	35	23	29	11	3
B	35	23	29	11	3
C	39	19	28	10	3
D	58	4	25	10	3
E	35	22	29	11	3

Table 108. Percentages of winter recreation opportunity spectrum classes on the Custer Gallatin National Forest by alternative

Alternative	Primitive percent	Semi-Primitive Nonmotorized percent	Semi-Primitive Motorized percent	Roaded Natural percent	Rural percent
A	34	20	33	10	3
B	35	20	33	9	3
C	39	16	32	10	3
D	58	5	25	9	3
E	34	20	33	10	3

Current Plans

Management Direction under the Current Plans

The current plans' summer and winter recreation opportunity spectrum maps were derived using current travel decisions and site-specific knowledge from forest personnel. Travel plans would continue to provide site-specific direction for where motorized uses could take place. Recreation settings would continue to be managed under the 1986 Custer Forest Plan. Unlike the Gallatin recreation opportunity spectrum classification, the Custer Forest Plan does not classify all designated wilderness as primitive. The borders of designated wilderness may be influenced by the buffering effect of adjacent classifications. The recreation opportunity spectrum direction was removed from the 1987 Gallatin Forest Plan and placed in the Gallatin Travel Plan. Table 109 displays the current forestwide summer and winter recreation opportunity spectrum classes. Table 110 and table 111 display the geographic area acres of each desired recreation opportunity spectrum by alternative for summer and for winter, respectively. Refer to appendix B for maps of the current plans recreation opportunity spectrum.

Table 109. Forestwide recreation opportunity spectrum settings in acres and percent of the national forest under the current plans

Recreation Opportunity Spectrum Class	Summer Acres	Summer Percent of National Forest	Winter Acres	Winter Percent of National Forest
Primitive	1,053,280	35	1,047,357	34
Semi-primitive Nonmotorized	692,178	23	601,875	20
Semi-primitive Motorized	876,011	29	998,300	33
Roaded Natural	323,062	11	299,809	10
Rural	94,644	3	91,832	3

Alternative A represents the current plans' future projections if kept

Table 110. Summer recreation opportunity spectrum settings in acres by geographic area under the current plans

Geographic Area	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural
Sioux	0	0	122,406	40,683	1,371
Ashland	0	33,578	319,673	82,883	0
Pryors	0	20,654	43,642	10,770	0
Absaroka-Beartooth	919,059	213,904	116,669	57,948	45,698
Bridger, Bangtail, Crazy	0	103,529	77,172	21,566	2,758
Madison, Gallatin, Henrys Lake	134,221	320,514	196,449	109,211	44,816
Total	1,053,280	692,179	876,011	323,061	94,643

Alternative A represents the current plans' future projections if kept

Table 111. Winter recreation opportunity spectrum settings in acres by geographic area under the current plans

Geographic Area	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural
Sioux	0	0	122,406	40,683	1,371
Ashland	0	33,578	319,673	82,883	0
Pryors	0	20,654	43,642	10,770	0
Absaroka-Beartooth	913,533	148,136	216,639	33,651	41,318
Bridger, Bangtail, Crazy	0	81,489	99,186	21,587	2,763
Madison, Gallatin, Henrys Lake	133,824	319,926	204,269	104,061	43,131
Total	1,047,357	603,783	1,005,815	293,635	88,583

Alternative A represents the current plans' future projections if kept

Effects of the Current Plans

As shown in table 109 the three largest summer recreation opportunity spectrum classes on the forest are primitive (35 percent), semi-primitive motorized (29 percent), and semi-primitive nonmotorized (23 percent). Combining the two nonmotorized classes (primitive and semi-primitive nonmotorized), 57 percent of the Custer Gallatin is in a nonmotorized setting. This is primarily because of two designated wilderness areas (Absaroka Beartooth and Lee Metcalf) and large amounts of inventoried roadless areas (848,091 acres). Combining the three summer motorized classes (semi-primitive motorized, roaded natural, and rural), 43 percent of the Custer Gallatin is in a summer motorized setting. As stated above, the Custer Forest Plan does not classify all designated wilderness as primitive, allowing the buffers of adjacent recreation opportunity spectrum classifications to flow into wilderness. While the mapping effect is not reflected in changes in wilderness management, it is reflected in acres of primitive being less than the total acres of designated wilderness under the current plans.

As shown in table 109, the three largest winter recreation opportunity spectrum settings on the Custer Gallatin are primitive (34 percent), semi-primitive motorized (33 percent), and semi-primitive nonmotorized (20 percent). Also shown in table 109, there is only a slight change in recreation opportunity spectrum settings between summer and winter.

While recreation opportunity spectrum direction is in the current Custer Forest Plan, direction was removed from the current Gallatin Forest Plan and placed in the Gallatin Travel Plan. In the current plans, recreation opportunity spectrum direction would continue to be in different documents and be inconsistent with 2012 Planning Rule direction.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

The 2012 Planning Rule requires the mapping of desired recreation opportunity spectrum classes and the use of this information in revised forest plans. The recreation opportunity spectrum classes vary by alternative in concert with the varying land allocations. Plan direction on how to manage the settings, opportunities, and access under the does not vary by alternative. For winter recreation opportunity spectrum in all revised plan alternatives, groomed cross-country ski trails are mapped as semi-primitive nonmotorized.

Plan components and direction for various recreation uses are described in narratives following the recreation opportunity spectrum discussion. Travel plans would continue to provide site-specific direction for where motorized uses could take place. Additional management direction for recreation may also be provided through recreation special use permits, or, in the cases where recreation uses need to be restricted, through regulatory closure orders outside of travel plans.

Effects Common to the Revised Plan Alternatives

Revised plan alternatives establish desired recreation opportunity spectrum classes for both summer and winter recreation settings that provide overall guidance and set expectations for the recreation settings on the Custer Gallatin. Desired recreation opportunity spectrum classes would aid in managing both existing and emerging recreation uses. Setting clear expectations and identifying a spectrum of settings for recreation users is important to management in the long term of recreation use on the Custer Gallatin.

Alternative B

Management Direction under Alternative B

In alternative B the winter and summer primitive recreation opportunity spectrum class consists of only designated wilderness. Recommended wilderness is mapped as semi-primitive nonmotorized. Table 112 displays the current forestwide summer and winter recreation opportunity spectrum classes. Table 113 and table 114 display the geographic area acres of each desired recreation opportunity spectrum by alternative for summer and for winter, respectively. Refer to appendix B for maps of alternative B recreation opportunity spectrum. Rounding may cause higher or lower than 100 percent in totals.

Table 112. Alternative B forestwide recreation opportunity spectrum settings in acres and percent of the national forest

Recreation Opportunity Spectrum Class	Summer Acres	Summer Percent of National Forest	Winter Acres	Winter Percent of National Forest
Primitive	1,053,064	35%	1,047,147	35%
Semi-primitive Nonmotorized	698,606	23%	608,495	20%
Semi-primitive Motorized	871,358	29%	1,002854	33%
Roaded Natural	321,867	11%	292,250	9%
Rural	94,269	3%	88,416	3%

Table 113. Alternative B summer recreation opportunity spectrum settings in acres by geographic area

Geographic Area	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural
Sioux	0	0	121,323	41,766	1,371
Ashland	0	33,577	319,663	82,883	0
Pryors	0	22,126	42,510	10,430	0
Absaroka-Beartooth	918,843	215,113	116,669	56,977	45,676
Bridger, Bangtail, Crazy	0	103,529	77,172	21,566	2,758
Madison, Gallatin, Henrys Lake	134,221	324,261	194,021	108,245	44,463
Total	1,053,064	698,606	871,358	321,867	94,269

Table 114. Alternative B winter forestwide recreation opportunity spectrum settings in acres by geographic area

Geographic Area	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural
Sioux	0	0	121,323	41,766	1,371
Ashland	0	33,578	319,663	82,883	0
Pryors	0	22,126	42,510	10,430	0
Absaroka-Beartooth	913,323	149,308	215,837	33,651	41,158
Bridger, Bangtail, Crazy	0	81,489	99,186	21,587	2,763
Madison, Gallatin, Henrys Lake	133,824	321,995	204,335	101,932	43,124
Total	1,047,147	608,495	1,002,854	292,250	88,416

Effects of Alternative B

Compared to the current plans, alternative B acres varies only slightly, resulting from more accurate mapping of the desired recreation opportunity spectrum for each recommended wilderness areas. This indicates the departure from desired recreation opportunity spectrum in alternative B recommended wilderness area is relatively small. There are no changes to open roads or motorized trails in alternative B compared to the existing condition in the current plans.

Alternative C

Management Direction under Alternative C

In alternative C for the winter and summer recreation opportunity spectrum mapping, the primitive classification consists of both recommended and designated wilderness. Table 115 displays the current forestwide summer and winter recreation opportunity spectrum classes. Table 116 and table 117 display the geographic area acres of each desired recreation opportunity spectrum by alternative for summer and for winter, respectively. Refer to appendix B for maps of alternative C recreation opportunity spectrum.

Table 115. Alternative C forestwide recreation opportunity spectrum settings in acres and percent of the national forest

Recreation Opportunity Spectrum Class	Summer Acres	Summer Percent of National Forest	Winter Acres	Winter Percent of National Forest
Primitive	1,199,656	39%	1,193,871	39%
Semi-primitive Nonmotorized	589,157	19%	498,148	16%
Semi-primitive Motorized	840,452	28%	969,953	32%
Roaded Natural	317,887	10%	291,222	10%
Rural	92,011	3%	85,970	3%

Table 116. Alternative C- Summer recreation opportunity spectrum settings in acres by geographic area

Geographic Area	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural
Sioux	0	0	121,323	41,766	1,371
Ashland	0	47,040	307,583	81,501	0
Pryors	6,838	31,136	28,249	8,884	0
Absaroka-Beartooth	921,061	212,873	116,669	56,976	45,699
Bridger, Bangtail, Crazy	0	103,529	77,172	21,566	2,758
Madison, Henrys Lake, Gallatin	271,758	194,580	189,457	107,233	42,182
Total	1,199,657	589,157	840,452	317,887	92,010

Table 117. Alternative C winter recreation opportunity spectrum settings in acres by geographic area

Geographic Area	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural
Sioux	0	0	121,323	41,766	1,371
Ashland	0	47,040	307,583	81,501	0
Pryors	6,838	31,136	28,249	8,844	0
Absaroka-Beartooth	915,535	147,101	215,833	33,651	41,158
Bridger, Bangtail, Crazy	0	81,489	99,186	21,587	2,763
Madison, Henrys Lake, Gallatin	271,499	191,382	197,781	103,871	40,678
Total	1,193,871	498,148	969,953	291,222	85,970

Effects of Alternative C

Changes in the recreation opportunity spectrum in alternative C result from more recommended wilderness acres than alternatives A and B as well as mapping recommended wilderness areas as primitive. This alternative offers the second highest amount of opportunities for recreation activities (39 percent) seeking remote locations with little managerial presence on the ground, few facilities, and large areas offering solitude. Summer semi-primitive nonmotorized decreases to a very small portion of the Custer Gallatin (4 percent), which would limit areas for larger group gatherings, recreation events away from developed or motorized settings, unroaded locations with cabins and other facilities, and less trail infrastructure such as bridges and signs.

Alternative D

Management Direction under Alternative D

In alternative D for the winter and summer recreation opportunity spectrum mapping, the primitive classification consists of both recommended wilderness and designated wilderness. Table 118 displays the current forestwide summer and winter recreation opportunity spectrum classes. Table 119 and table 120 display the geographic area acres of each desired recreation opportunity spectrum by alternative for summer and for winter, respectively. Refer to appendix B for maps of alternative D recreation opportunity spectrum.

Table 118. Alternative D forestwide recreation opportunity spectrum settings in acres and percent of the national forest

Recreation Opportunity Spectrum Class	Summer Acres	Summer Percent of National Forest	Winter Acres	Winter Percent of National Forest
Primitive	1,760,685	58%	1,758,890	58%
Semi-primitive Nonmotorized	121,988	4%	143,504	5%
Semi-primitive Motorized	750,104	25%	722,860	25%
Roaded Natural	315,680	10%	278,159	9%
Rural	90,706	3%	85,750	3%

Table 119. Alternative D summer recreation opportunity spectrum settings in acres by geographic area

Geographic Area	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural
Sioux	0	2,235	119,322	41,532	1,371
Ashland	37,245	8,078	308,722	82,079	0
Pryors	43,883	0	23,688	7,496	0
Absaroka-Beartooth	1,125,904	37,262	87,966	55,767	43,388
Bridger, Bangtail, Crazy	91,934	24,636	64,177	21,520	2,758
Madison, Henrys Lake, Gallatin	458,718	49,778	146,230	107,296	43,189
Total	1,760,685	121,988	750,104	315,680	90,706

Table 120. Alternative D winter recreation opportunity spectrum settings in acres by geographic area

Geographic Area	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural
Sioux	0	2,235	119,322	41,532	1,371
Ashland	37,245	8,078	308,722	82,079	0
Pryors	43,883	0	23,688	7,496	0
Absaroka-Beartooth	1,127,686	33,897	118,958	32,906	39,831
Bridger, Bangtail, Crazy	91,983	28,474	60,573	21,237	2,758
Madison, Henrys Lake, Gallatin	458,092	70,820	141,599	92,909	41,790
Total	1,758,890	143,504	772,860	278,159	85,750

Effects of Alternative D

The large increase in primitive recreation opportunity spectrum in alternative D is a result of a larger amount of recommended wilderness in this alternative. At 58 percent, this alternative offers the highest amount of opportunities for recreation activities seeking remote locations with little managerial presence on the ground, few facilities, and large areas offering solitude. Summer semi-primitive nonmotorized decreases to a very small portion of the Custer Gallatin (4 percent), which would limit areas for larger group gatherings, recreation events away from developed or motorized settings, unroaded locations with cabins and other facilities, and less trail infrastructure such as bridges and signs. Recreation opportunities for summer semi-primitive motorized also are reduced.

Alternative E

Management Direction under Alternative E

In alternative E for the winter and summer recreation opportunity spectrum mapping, the primitive classification consists of only designated wilderness, as there is no recommended wilderness. Table 121 displays the current forestwide summer and winter recreation opportunity spectrum classes. Table 122 and table 123 display the geographic area acres of each desired recreation opportunity spectrum by alternative for summer and for winter, respectively. Refer to appendix B for maps of alternative E recreation opportunity spectrum.

Table 121. Alternative E forestwide recreation opportunity spectrum settings in acres and percent of the national forest

Recreation Opportunity Spectrum Class	Summer Acres	Summer Percent of National Forest	Winter Acres	Winter Percent of National Forest
Primitive	1,053,070	35%	1,047,148	34%
Semi-primitive Nonmotorized	681,116	22%	595,617	20%
Semi-primitive Motorized	883,331	29%	1,011,032	33%
Roaded Natural	323,595	11%	294,057	10%
Rural	98,051	3%	91,310	3%

Table 122. Alternative E summer recreation opportunity spectrum settings in acres by geographic area

Geographic Area	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural
Sioux	0	0	121,323	41,766	1,371
Ashland	0	33,578	319,663	82,883	0
Pryors	0	21,510	42,786	10,770	0
Absaroka-Beartooth	918,849	213,890	116,669	58,189	45,681
Bridger, Bangtail, Crazy	0	103,345	74,722	20,774	6,184
Madison, Henrys Lake, Gallatin	134,221	308,793	208,169	109,211	44,816
Total	1,053,070	681,116	883,331	323,593	98,052

Table 123. Alternative E- Winter recreation opportunity spectrum settings acres by geographic area

Geographic Area	Primitive	Semi-Primitive Nonmotorized	Semi-Primitive Motorized	Roaded Natural	Rural
Sioux	0	0	121,323	41,766	1,371
Ashland	0	33,578	319,663	82,883	0
Pryors	0	21,510	42,786	10,770	0
Absaroka-Beartooth	913,324	148,117	216,639	33,651	41,546
Bridger, Bangtail, Crazy	0	78,391	99,186	21,336	6,112
Madison, Henrys Lake, Gallatin	133,824	314,021	211,436	103,649	42,280
Total	1,047,148	595,617	1,011,032	294,055	91,309

Effects of Alternative E

Alternative E has the least amount of primitive recreation opportunity spectrum as there is no recommended wilderness in this alternative. The recreation opportunity spectrum classification in the wilderness study area reflects the recreation opportunity spectrum of the 2006 Gallatin Travel Plan and would allow more semi-primitive motorized opportunity than the current situation or other revised plan alternatives. Wilderness study area direction would be followed unless Congress released the wilderness study area. This alternative offers the least acreage for opportunities offered by a primitive recreation opportunity spectrum setting and the fewest areas offering solitude, self-reliance, and less infrastructure such as facilities and bridges. There would be an increase in the opportunities for recreation opportunities offered by a roaded natural or semi-primitive motorized setting.

Consequences to Recreation Settings from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Timber Management

All revised plan alternatives establish location where timber production and timber harvest are suitable and not suitable. No lands in the primitive recreation opportunity spectrum category are suitable for timber production. Between six and eleven percent of lands in the semi-primitive nonmotorized recreation opportunity spectrum category are suitable for timber production. Timber production activities would be most noticeable in the semi primitive motorized, roaded natural, and rural recreation opportunity spectrum settings. The sights and sounds of timber harvest and associated road building activities may temporarily impact nonmotorized recreation settings. Areas of active timber sales, may have an increase in road maintenance, which could mean less maintenance on road systems for specific recreation destinations.

Table 124. Percent of summer recreation opportunity spectrum classes by alternative, for lands suitable for timber production

Recreation Opportunity Spectrum Class	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Primitive	0%	0%	0%	0%	0%
Semi-Primitive Nonmotorized	11%	9%	9%	6%	11%
Semi-Primitive Motorized	58%	60%	60%	62%	59%
Roaded Natural	26%	26%	26%	27%	25%
Rural	5%	5%	5%	5%	5%
Total	100%	100%	100%	100%	100%

Alternative A represents the current plans' future projections if kept

Effects from Scenery Management

The recreation opportunity spectrum plan components in the revised plan alternatives describe the general desired settings appropriate for each class in the immediate recreating environment. However, while the scenery management plan components are complementary to recreation opportunity spectrum, they apply to what viewers see in the foreground to the distant horizons from identified viewing platforms. The current plans lack guidance on how to apply scenery plan components in recreation opportunity spectrum settings.

Effects from Minerals Management

Under all alternatives, active mining may occur across all recreation settings within the Custer Gallatin National Forest. New and ongoing mining may affect the recreation settings by creating roads and opening that might not normally be located within certain settings. Additionally, mine reclamation may have impacts on recreation settings, at least in the short term and may restore the setting in the long term.

3.19.4 Developed and Dispersed Recreation Affected Environment (Existing Condition)

The Custer Gallatin has a robust developed recreation program that provides a wide range of opportunities appropriate to their recreation settings. Developed recreation opportunities are located at specific locations or sites and have infrastructure or features designed to protect the resources, reduce conflicts, and provide for safety. Depending upon the location and the facilities available, these developed sites may or may not have fees associated with them.

Developed recreation sites provide much of the infrastructure necessary for the enjoyment of a wide variety of recreation activities in the analysis area. Sustainable recreation sites are generally managed on a continuum based on a development scale ranging from 1 to 5. Table 125 shows the Forest Service definition of developed recreation site is a recreation site on National Forest System lands that has a development scale of 3, 4, or 5.

Table 125. Recreation site development scales

Development Scale	Definition	Developed or Dispersed	ROS Setting(s)
1	Recreation sites with minimum site modification. Rustic or rudimentary improvements designed for protection of the site rather than comfort of the users. Use of synthetic materials excluded. Minimum controls are subtle. No obvious regimentation. Spacing informal and extended to minimize contacts between users. Motorized access not provided or permitted.	Dispersed	Primitive
2	Recreation sites with little site modification. Rustic or rudimentary improvements designed primarily for protection of the site rather than the comfort of the users. Use of synthetic materials avoided. Minimum controls are subtle. Little obvious regimentation. Spacing informal and extended to minimize contacts between users. Motorized access provided or permitted. Primary access over primitive roads. Interpretive services informal.	Dispersed	SPNM and SPM
3	Recreation sites with moderate modification. Facilities about equal for protection of natural site and comfort of users. Contemporary/rustic design of improvements is usually based on use of native materials. Inconspicuous vehicular traffic controls usually provided. Roads may be hard surfaced and trails formalized. Development density about three family units per acre. Primary access may be over high standard roads. Interpretive services informal, but generally direct.	Developed	Roaded Natural
4	Recreation sites that are heavily modified. Some facilities designed strictly for comfort and convenience of users. Luxury facilities not provided. Facility design may incorporate synthetic materials. Extensive use of artificial surfacing of roads and trails. Vehicular traffic control usually obvious. Primary access usually over paved roads. Development density about three to five family units per acre. Plant materials usually native. Interpretive services often formal or structured.	Developed	Rural
5	Recreation sites with a high degree of site modification. Not found on the Custer Gallatin National Forest.	Developed	Urban

Note: SPNM is semi-primitive nonmotorized; SPM is semi-primitive motorized; ROS is recreation opportunity spectrum

The 63 developed campgrounds and picnic areas on the Custer Gallatin provide a wide range of settings and levels of development. Most of the picnic areas and campgrounds are located along or near lakes or rivers and are usually in forested settings. In general, these locations developed over time; many after World War II when family camping started to become popular. To protect resources, facilitate camping and picnicking opportunities, and decrease conflicts, the Forest Service developed areas by adding facilities and designed camp and picnic sites, roads, and information boards.

All of the campgrounds on the Custer Gallatin are consistent with the nationally recognized niche of Forest Service campgrounds being on the rustic end of the spectrum. None of the campgrounds on the Custer Gallatin has flush toilets, showers, or constructed playgrounds for children, though some have pressurized water systems or hand pumps. The campgrounds range from very rustic areas with no facilities to large, more developed, sites with amenities such as electrical hookups for recreational vehicles, accessible interpretive trails, and safety features, such as bear-resistant food storage containers.

Two different concessionaires operate and maintain twenty-three campgrounds and two pavilions on the Custer Gallatin National Forest under special use permits. Concessionaires are privately owned companies that operate and maintain campgrounds and picnic areas under the authority of the Granger Thye Act of 1950. Per the terms and conditions established in the special use authorizations, the concessionaires either pay a predetermined percentage of the revenue collected at each site to the Federal Treasury or can enter into an agreement to invest those funds in the maintenance and improvement of infrastructure at these campground and picnic areas.

Table 126. Number of Forest Service (FS) developed campgrounds run by agency or concessionaires

Geographic Area	FS Operated (No Fee)	FS Operated (Fee)	Concession Operated	Total Number
Sioux	5	0	0	5
Ashland	4	0	0	4
Pryor Mountains	1	0	0	1
Bridger, Bangtail, Crazy Mountains	2	2	0	4
Absaroka Beartooth Mountains	11	12	10	33
Madison, Henrys Lake, Gallatin Mountains	5	2	13	20
Total	28	16	23	63

There are 27 recreation rental opportunities; 25 cabins, and 2 lookouts available to the public for rent (table 127). Built primarily in the 1920s and 1930s for use by early forest rangers, the cabins offer visitors a chance to camp in the forest in a rustic, old-time setting. Some of the cabins have electricity. All have either wood or electric stoves for cooking and heating. Very few have indoor plumbing. Some of the cabins are located right on a road; others require users to hike, ski, or snowmobile to them. Disproportionally located on the west side of the Custer Gallatin National Forest, none is located in the Pryor Mountains or the Sioux District. The condition of the facilities at each of the rental cabins varies widely. Although key investments have been made to resolve critical health and safety issues there is a back log of operational and deferred maintenance work that is not being achieved under current budget scenarios.

In addition to the cabin, camping, and picnicking opportunities, the Custer Gallatin National Forest offers developed interpretive sites, visitor centers, fishing sites, wildlife observation and viewing sites, fire towers, and many other developed recreation opportunities. Table 128 identifies the number of Forest Service recreation sites on the Custer Gallatin by categories of developed recreation sites.

Table 127. Custer Gallatin National Forest recreation rental cabins

Geographic Area	Number of Cabins	Number of Lookouts	Total
Sioux	0	0	0
Ashland	1	1	2
Pryor Mountains	0	0	0
Absaroka Beartooth Mountains	6	0	6
Bridger, Bangtail, Crazy Mountains	4	0	4
Madison, Henrys Lake, Gallatin Mountains	14	1	15
Total	25	2	27

Table 128. Other developed recreation sites and facilities managed and maintained by the Custer Gallatin National Forest

Geographic Area	Boating Sites	Interpretive Sites	Picnic Areas	Observation Wildlife Viewing	FS Ski Area Nordic	Trail-heads	Total
Sioux	0	0	1	1	0	0	2
Ashland	0	0	2	0	0	0	2
Pryor Mountains	0	0	1	0	0	0	1
Absaroka Beartooth Mountains	3	9	8	5	0	76	101
Bridger, Bangtail, Crazy Mountains	0	0	2	3	0	27	32
Madison, Henrys Lake, Gallatin Mountains	8	9	8	0	1	74	100
Total	11	18	22	9	1	177	238

Trailheads are the most numerous type of developed recreation facility on the Custer Gallatin National Forest. Trailheads range from those having designed, constructed, and surfaced parking, horse facilities, vault toilets, and extensive information and interpretation kiosks, to those with only informal parking areas with a small bulletin board or sign. In addition to specific categories, such as campgrounds or trailheads, the other developed recreation category includes day-use sites such as boat and fishing facilities.

Dispersed recreation opportunities include overnight camping, at the development scales 1 and 2 as described in table 129. Camping along a trail or roadside in a dispersed site is a classic use of the national forest. Most areas are located within roaded natural and semi-primitive motorized recreation opportunity spectrum classifications.

In 2009, the Northern Region began developing a standardized protocol for inventorying and monitoring resource conditions of areas associated with dispersed recreation. The Custer Gallatin began this inventory outside wilderness in 2014. The focus has been primarily adjacent to main forest access routes, with a priority on concentrated use areas, with limited or no infrastructure or facilities outside of the access route and directional signage.

Dispersed inventories completed to date have located over 1,332 individual sites outside wilderness. The Custer Gallatin National Forest's long-term goal is to have comprehensive information about dispersed recreation use across the Custer Gallatin.

Table 129. Inventoried dispersed recreation sites

Geographic Area	Dispersed Campsites	Wilderness Campsites	Day Use Area	Fishing/ River Site	Climbing Area	Total
Sioux	95	0	3	0	0	98
Ashland	92	0	0	0	0	92
Pryor Mountains	21	0	0	0	0	21
Absaroka Beartooth Mountains	696	1,373	55	18	4	2,146
Bridger, Bangtail, Crazy Mountains	68	0	2	0	0	70
Madison, Henrys Lake, Gallatin Mountains	114	324	55	105	4	602
Total	1,086	1,697	115	123	8	3,631

There are many dispersed recreation activities that do not include overnight camping. Birdwatching, fishing, hunting, berry picking, rock and ice climbing, hiking, horseback riding, motorcycle riding, viewing wildlife, and photography. These recreational uses span the recreation opportunity spectrum as some are motorized or adjacent to roads while others are not. The recreational use of pack goats on the Custer Gallatin is currently very limited, with few anecdotal occurrences noted. However, there are wildlife management concerns with potential disease transmission to bighorn sheep.

3.19.5 Developed and Dispersed Recreation Environmental Consequences

Effects of All Alternatives

In all alternatives, including no action, natural disturbances, recreation trends and use patterns, and emerging technologies would continue to influence the specific type, amount, and location of recreation opportunities across the Custer Gallatin National Forest. Travel plans would continue to provide site-specific direction for where motorized recreational uses can take place. Dead and dying trees, recent fires and other natural occurrences may impact the location and availability of some areas for recreation use. The health and safety of the recreating public would continue to influence recreation management, particularly at developed recreation sites, where visitor use is concentrated. Travel plans would continue to provide site-specific direction for where motorized recreational uses can take place.

Current Plans

Management Direction under the Current Plans

The 1986 Custer Forest Plan contains direction for dispersed recreation opportunities, stating they will be emphasized in response to public needs; signs will be used to guide the public to National Forest System lands. Brochures, maps, etc., will be developed to describe recreation opportunities available; to emphasize minimum impact camping dispersed use will be managed to prevent site deterioration. Generally, no specific campsites will be established or maintained; minimum impact camping techniques will be encouraged through public information. Camping associated with dispersed use will be restricted to at least 100 feet from live streams.

Custer Forest Plan direction for developed recreation facilities states that management of the recreation resource is moderately intensive and developed recreation sites will be operated at a full service level. There will be some additions to existing facilities to accommodate the increased need for developed recreation on the Custer Gallatin. These additions would be to enlarge existing facilities across the national forest and develop sites on the Ashland Ranger District and possible expansion of the Red Lodge Mountain Ski Area. Management Area F is specific to developed recreation and the access corridors to those sites. It proposed to consider impacts from other management activities on recreation sites and not allow detrimental effects, accomplish operation and maintenance according to standards, close facilities if safety and sanitation cannot be provided; bring sites up to design capacity if demand warrants. To prevent overuse and crowding, limitations will be applied to campground stays, and possibly a permit system will be implemented.

Both current plans provide dispersed recreation and developed sites direction in various recreation opportunity spectrum settings, although the settings are not specifically mapped. The two current forest plans include some restrictions for dispersed recreation, which is not found in the revised plan alternatives, including restricting camping within 100 feet of a live stream, and using limits of acceptable change (LAC) as the method to monitor dispersed campsites.

The 1987 Gallatin Forest Plan Management Area direction tends to associate the level of dispersed recreation expected with lands suitable or not suitable for timber harvest, and ease of road access. For example dispersed recreation opportunities will be provided at a low level of investment that focuses primarily on travel planning and trail maintenance and, in the event of disruption from timber harvest activities, trail relocation. Management activities will be oriented toward reducing the impacts associated with recreation activities on other resource values, including protection of soil and water quality. Much of the dispersed recreation components were changed by amendment to the Gallatin Travel Plan. There is still direction for cooperative efforts with interested clubs, organizations, and other public agencies will be continued to provide for a wide variety of dispersed recreation activities. Cooperators will be encouraged to assist with development, operation, and maintenance of both summer and winter trail systems. Dispersed recreation use will be managed to provide users with a wide range of opportunities to meet increasing demand while protecting forest resources.

The Gallatin Forest Plan’s developed recreation direction includes more emphasis on the maintenance of developed recreation sites and new recreation facility development where there is an increase in public need. There is a plan component to keep individual camping units away from shorelines. The Custer Gallatin’s administrative cabin rental program will be continued and facilities for those with disabilities will be considered when recreation sites are being constructed or upgraded. The private sector will be encouraged to provide facilities and services on private land where needed to serve the public. Management Area 1 areas include all developed recreation sites, such as campgrounds, picnic areas, boat ramps, visitor information sites, air strips, recreation residence tracts, and recreation rental cabins. Goals are to maintain these sites and facilities for the safety and enjoyment of users, and to provide additional facilities where analysis shows the need.

Gallatin Forest Plan Amendment 51 limits construction of new developed recreation sites within the grizzly bear recovery zone or primary conservation area as outlined in the Greater Yellowstone Area Grizzly Bear Conservation Strategy. There is no mention of a wildlife food storage order in either existing plan, although the Custer Gallatin does have an existing closure order for all ranger districts excluding the Ashland and Sioux. The current plans have no prohibitions on the recreational or outfitter use of pack goats.

Effects of the Current Plans

As both current plans use the limits of acceptable change for monitoring dispersed recreation sites, the effect of this is that there is an ongoing monitoring system and documentation of location and current site conditions for many dispersed recreation sites across the Custer Gallatin, using a standard protocol. The current plan components limiting camping within 100 feet of a live stream is only in the current plans. The recreational or outfitter use of pack goats is allowed.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

Forest plan direction for developed and dispersed recreation does not vary in the revised plan alternatives. Developed recreation components state that recreation opportunity spectrum design criteria would be followed, hazard tree removal would involve consulting wildlife managers for seasonal restrictions; timber production, grazing permits, and extraction of saleable mineral materials are not suitable uses of developed recreation sites. Additionally, partnerships would be sought to provide general capacity to meet the desires of the public and public safety is a priority.

Dispersed recreation management issues are also included with the components for different classifications of the recreation opportunity spectrum. There is a desire to provide a wide variety of settings for the public use. A goal is to engage with the rock climbing community developing solutions to issues as they arise.

Under alternatives B and C, recreational use of pack goats would not be suitable within the Madison, Henrys Lake, Gallatin Mountains Geographic Area, the Absaroka-Beartooth Mountains Geographic Area, or the Pryor Mountains Geographic Area. Under alternative D, recreational use of pack goats would not be suitable forestwide. Alternative E would not restrict recreational use of pack goats.

Effects of the Revised Plan Alternatives

The effects of the revised plan alternatives include implementing a combined recreation niche of the previous two national forests into one, which provides more cohesive vision for management. In accordance with plan direction, the season of use for recreation facilities will be adaptable to changing climates, which may result in longer or shorter operating seasons. The emphasis on integrating a universal design for accessible recreation facilities and maintaining facilities to full standards for sustainability components will result in more developed recreation facilities having greater accessibility. Hazard tree removal components, including coordination with wildlife manager’s involvement, should limit impacts to wildlife during tree removal. Permitted livestock grazing components that avoid the operating season of recreation sites should limit visitors experiencing the impacts of livestock in the areas where they are camping and recreating. In response to a plan goal, the Custer Gallatin staff will seek partnerships that may result in other sectors filling the role of expanded recreation capacity for national forest users.

Consequences to Developed and Dispersed Recreation from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Vegetation and Timber Management

Timber production is not suitable in developed recreation sites. Timber management activities taking place outside of developed recreation sites may be noticeable from within developed recreation sites.

Dispersed recreation sites may be located within or very near timber harvest units and may cause visitors to relocate until activities are completed.

Plan components provide for hazard tree removal in developed recreation sites to provide for visitor safety, even where timber production is not suitable. Dispersed recreation areas typically do not have systematic hazard tree removal.

Effects from Fire and Fuels Management

Wildland fires would continue to affect the ecological processes, in the long term, across recreation settings and may impact the location and availability of recreation opportunities on the Custer Gallatin. Fire could create a temporary loss of vegetation, reduction in water quality due to sedimentation, reduction in recreation access to some recreation opportunities, and air pollution which could cause displacement of some forest visitors to other areas on the Custer Gallatin or to other national forests in the region.

Fire and fuels plan components envision vegetation conditions that would support low-intensity fire adjacent to infrastructure to reduce negative impacts to values at risk such as developed recreation sites. Fuels could be treated in areas around developed recreation facilities to reduce likelihood of loss during wildfires.

Effects from Watershed, Riparian, and, Aquatic Management

Plan components and activities related to watershed, riparian, or aquatic habitat improvements would affect new developed and dispersed recreation opportunities, especially riparian management zone plan components. The revised plan alternatives riparian management zones are greater in size from the riparian zones currently identified for streams east of the Continental Divide. Many developed and dispersed recreation sites are located in riparian management zones and near sources of water across the Custer Gallatin. Aquatic plan components may limit new developed and dispersed recreation sites in riparian management zones. Construction of new developed recreation sites, including considerations for outhouse location and water systems, would need to meet more stringent requirements. Vegetation management in the riparian management zones within recreation areas would also need to meet plan components. Where possible new recreation sites and facilities would be located outside of riparian management zones. Plan components in the revised plan encourage the removal or relocation of recreation facilities that are currently within riparian management zones if they are degrading aquatic or riparian resources.

In summary, the revised plan alternative riparian management zone direction may limit or restrict the development of certain recreation opportunities or facilities within these zones and over time may decrease the number of recreation facilities found in those areas.

Effects from Wildlife Management

All revised plan alternatives continue current direction requiring food storage orders, (excluding Ashland and Sioux Geographic Areas), and would provide for public safety when sharing areas with bears and other wildlife. Key wildlife linkage area components would restrict future developed recreation facilities and motorized and non-motorized trails, unless needed to address ongoing or imminent resource issues within the key linkage area.

Construction of new developed recreation sites would be limited within the Greater Yellowstone Area Grizzly Bear Conservation Strategy Recovery Zone boundaries in all alternatives. The number and capacity of developed sites must be maintained at or below 1998 baseline levels; that is, it limits the number of new developed recreation sites (including overnight campsites) that may be built, as well as expansion of existing sites, to the number and capacity that existed in 1998. This hinders the ability to provide more capacity for overnight camping in forest areas where population pressures and tourism are expected to increase. There has also been concern that lack of additional overnight developed recreation campsites in popular locations moves campers to dispersed camping, where encounters with bears may be more likely and there are no food storage facilities or interpretive signing to educate visitors on camping in bear prone areas.

As a safeguard on possible disease transmission from domestic goats to bighorn sheep, in alternatives B and C recreational use of pack goats would not be suitable within the Madison, Henrys Lake, Gallatin Mountains Geographic Area, the Absaroka-Beartooth Geographic Area, or the Pryor Mountains Geographic Area. Under alternative D, recreational use of pack goats would not be suitable forestwide. The current plans and alternative E would not restrict recreational use of pack goats. Forest managers on the Custer Gallatin have noted very few instances of current recreational use of pack goats; therefore, alternatives B, C, and D would likely affect few recreationists.

Effects of Land Allocations

The effects of recommended wilderness plan components on developed and dispersed recreation will vary by alternative. Some recommended wilderness areas contain developed recreation sites, such as the Windy Pass rental cabin, and depending on the alternative, the use of the cabin as a public rental facility may be eliminated. Some dispersed recreation activities, such new motorcycle or bicycle trails in alternative B and current or new motorcycle and bike riding in alternatives C and D, would be restricted in recommended wilderness.

In all alternatives, new recreation developments would not be allowed in recommended wilderness areas. In the revised plan alternatives, new recreation events would not be allowed in recommended wilderness areas and the Buffalo Horn and West Pine backcountry areas; new recreation events are not limited in the current plans or other backcountry areas in the revised plan alternatives. In the revised plan alternatives, new developed recreation facilities would not be allowed in backcountry areas while the current plans allow some new recreation development in low development areas.

Effects from Permitted Livestock Grazing and Management

Generally, the grazing of livestock is restricted within developed recreation sites and many developed recreation sites are surrounded by fencing to ensure grazing occurs outside of these areas. The revised plan alternatives provide suitability direction for the management of grazing within developed recreation sites. The revised plan alternatives share a guideline that states “In order to improve livestock distribution and reduce livestock attraction to special habitats, salt and supplement placement should not be within 0.25 mile of water developments, recreational developments… that are susceptible to livestock impacts.” This will reduce the impacts to developed recreation sites by not attracting grazing animals to those locations. However, grazing is more common within or near dispersed recreation sites where fences are less common and where there are fewer constructed recreation features. Dispersed recreationists may choose to camp away from areas of active grazing.

Effects from Cultural, Historic, and Tribal Resource Management

Many of the recreation residences and resorts on the Custer Gallatin National Forest are historic and need to be managed for their historic values in addition to their recreational values. Future expansion and remodeling of these requires additional planning and approval to ensure that historic values are not damaged. All alternatives provide plan components that would protect and enhance the historic resource values associated with recreation rental cabins, recreation summer homes, and developed recreation facilities.

Effects from Road Access and Infrastructure

Most developed and dispersed recreation sites are accessed from open roads and trails. Infrastructure, usually buildings and constructed campsites, tables, and fire rings are generally found at the most developed recreation sites. Forest plan components concerning deferred maintenance are described as facilities and recreation sites age, by stating that facilities will meet required maintenance standards. Travel plans establish where motorized use can or cannot take place and support and help maintain recreation opportunity spectrum settings for both summer and winter. All revised plan alternatives have plan components that provide future direction for road access and the construction or reconstruction and maintenance of infrastructure across the Custer Gallatin. In alternatives B, C, and D there is a plan objective to annually maintain forty percent of administrative facilities based on budgets, compared to alternative E where the objective would be twenty percent annually. The effect is that there would be higher visitor satisfaction with better maintained recreation facilities, such as backcountry rental cabins, visitor centers, and developed campgrounds under alternatives B, C, and D.

3.19.6 Recreation Special Uses Affected Environment (Existing Condition)

Recreation special use permits are issued to private businesses, individuals, institutions, and nonprofit groups to provide for occupancy and use of the national forest beyond what is normally available to the public. Permitted recreation uses provide specific recreational opportunities to the public and deliver economic benefits to rural economics. Examples of commercial enterprises requiring permits include ski resorts, outfitting and guiding service, resorts, and organizational camps. Noncommercial recreation uses are those that require special use specific groups, such as clubs, or are used by individuals and single families, such as recreation residences. The Forest Service issues these permits under the authority of a variety of specific laws. Table 130 displays recreation special uses by type and area.

Approximately 177 outfitter and guide permittees operate on the Custer Gallatin (table 131). The six operators on the Ashland and Camp Crook Districts exclusively provide hunting services. The remaining 171 operators provide a wide range of year-round services. There are currently no outfitters authorized for use of pack goats. However, there are wildlife management concerns with potential disease transmission from domestic goats to bighorn sheep.

Table 130. Recreation special uses by type and area

Geographic Area	Outfitter and Guide*	Recreation Residences	Alpine and Nordic Ski Areas	Organization Camps	Recreation Resorts	Shooting Ranges	Recreation Events	Total
Sioux	4	0	0	1	0	0	0	5
Ashland	2	0	0	0	0	0	1	3
Pryor Mountains	0	0	0	0	0	0	0	0
Bridger, Bangtail, Crazy Mountains	9	0	2	0	0	0	10	21
Absaroka, Beartooth Mountains	42*	126	1	5	0	0	0	174
Madison, Henrys, Gallatin Mountains	120*	167	1	1	3	1	40	333
Total:	177	293	4	7	3	1	51	536

*Outfitter number includes average annual temporary and priority permit holders

Table 131. Permitted outfitter and guide opportunities as of 2015

Permitted Activity Types	Approximate Authorized Days 2015
Backpacking	2,500
Boating/Rafting	28,000
Biking	110
Dog Sledding	350
Yurt/Camping	300
Environmental/Adventure Education	6,000
Fishing	4,250
Hiking	3,100
Horseback Trail Rides	32,500
Hunting	5,600
Shuttles/Livery	500
Mountaineering	500
Rock Climbing	5,750
Ice Climbing	725
Skiing	1,500
Snowmobiling	11,000
Snowshoeing	150
Wagon Rides	50
2015 Authorized Days	**102,885**

Recreation residences are privately owned cabins located on National Forest System land, authorized by special use permits which last 20 years. Permit holders pay an annual fee for their permit. On the Custer Gallatin, there are 293 recreation residences, which is the greatest number of all Northern Region national forests. Table 132 displays number of recreation residences by ranger district.

Table 132. Recreation residence locations

District	Number of permitted recreation residences
Ashland	0
Beartooth	96
Bozeman	86
Gardiner	0
Hebgen	80
Sioux	0
Yellowstone	31
Total Permits	293

There are two alpine ski areas and two Nordic ski areas that currently operate under special use permit on the Custer Gallatin.

Table 133. Ski area resorts and visitation numbers by year from 2014 to 2018

Ski Area	Geographic Area	Location	2014-2015 visitation	2015-2016 visitation	2016-2017 visitation	2017-2018 visitation
Red Lodge Mountain	Absaroka, Beartooth Mountains	Located along the eastern front of the Beartooth Mountains, approximately 6 miles west of the town of Red Lodge.	87,805	66,914	82,498	92,837
Bridger Bowl	Bridger, Bangtail, Crazy Mountains	Located approximately 15 miles north of Bozeman in the Bridger Mountains. With the base operations on private property accessing a variety of ski terrain on the Custer Gallatin National Forest.	204,501	244,916	227,777	244,464
Total Visitation	not applicable	not applicable	292,306	311,830	310,275	337,301

Crosscut Mountain Sports Center Ski Area is located approximately 18 miles north of Bozeman, in the Bridger Mountains. Two trails and approximately 8 kilometers are located on the Custer Gallatin National Forest, the remaining operation and all of the base facilities are on private property. Lone Mountain Ranch Nordic area is located in Big Sky. Approximately 10 kilometers of Forest Service Roads 166B and 166D and Forest Service Trail #16 are operated as groomed routes under special use permit. All of the base area and the remaining operation is on private property.

There are three commercial, privately owned resorts located on the Custer Gallatin National Forest. All are located on the Hebgen Ranger District in West Yellowstone. These commercial resorts are permitted under 20-year special use permits. Per the terms on their permits, any changes to the land or the exterior of their buildings must be submitted to the Forest Service for analysis of potential resource impacts. Table 134 lists the resorts within the Custer Gallatin and the services offered through the special use permit.

Table 134. Custer Gallatin recreation resorts

Resort Name	Location	Services
Camp Fire Lodge	Madison River	Cabins, camping, water access, food, laundry, etc.
Covered Wagon Ranch	Highway 191 at the mouth of the Taylor Fork drainage	Cabins, food, fishing, horse and hunting trips (authorized by a separate outfitter and guide permit)
Madison Arm Resort	Hebgen Lake	Cabins, campground, marina, activities

There are seven organizational camps currently operating in the Custer Gallatin National Forest (see table 135), under the most recent authority of the National Forest Organizational Camp Fee Improvement Act of 2003, which authorized the use and occupancy of National Forest System land for the purposes of organizational camps.

Table 135. Custer Gallatin organization camps

Organization Camp Name	Geographic Area	District
Camp Needmore	Sioux	Sioux
Hyalite Junior Camp	Madison, Henrys Lake, Gallatin Mountains	Bozeman
Mimanagish Camp	Absaroka Beartooth	Yellowstone
Templed Hills Camp	Absaroka Beartooth	Yellowstone
Timber Crest Girl Scout Camp	Absaroka Beartooth	Beartooth
Westminster Spires	Absaroka Beartooth	Beartooth
Billings Lions Club	Absaroka Beartooth	Beartooth

Finally, there are approximately 50 permits annually for recreation and competitive events on the Custer Gallatin National Forest, including activities from endurance racing to national ski competitions. These events largely occur on the Hebgen Lake and Bozeman Ranger Districts around the communities of West Yellowstone and Bozeman respectively.

3.19.7 Recreation Special Uses Environmental Consequences

Current Plans

Management Direction under the Current Plans

Forestwide direction in the 1986 Custer Forest Plan applied to special use permits for outfitter and guide services. Permits are to be issued as necessary to meet recreation objectives, not result in greater restrictions to the public to use and enjoy the national forests, not result in significant conflict with other permitted outfitters and guides, and consider other resources.

New organization camps are to be considered and assessed for compatibility with forest direction; special recreation oriented events are to be analyzed for compatibility with forest direction including public safety and sanitation.

The 1986 Custer Forest Plan Management Area R includes that portion of the West Fork of Rock Creek drainage that is outside of the Absaroka-Beartooth Wilderness and the developed recreation sites along the creek, and is the source of drinking water for the city of Red Lodge. Two standards focused on specific requirements for recreation special use permittees.

Wilderness management direction in the Absaroka-Beartooth Management Plan in Appendix II of the Custer plan) contains fairly extensive direction for permitting Outfitter Guides.

The 1987 Gallatin Forest Plan includes forestwide direction such as permitted special uses or concession arrangements on national forest lands will be relied on to meet demand; authorization of most existing recreation residences will continue into the foreseeable future. An assessment of the continuance of a recreation residence permit will be based upon the need for a higher public use. Recreation residences will generally not exceed 1,500 square feet of roofed or enclosed floor space.

Outfitter guide direction authorized a limit to hunting outfitter and guide activity levels not to exceed 10,758 total service days. Gallatin Forest Plan Appendix F contains the Absaroka-Beartooth wilderness management direction, with fairly extensive direction for permitting outfitter guides. Recreation events, resorts, and organizational camps are not addressed in the current Gallatin Forest Plan. The current plans have no specific prohibitions on permitted use of pack goats.

Expansion of Bridger Bowl, Big Sky, and the potential development of Ski Yellowstone Ski Areas will be given priority before any new proposals for downhill ski areas are approved.

Special use proposals will be evaluated on a case-by-case basis. Preference will be given to special use proposals that offer service or benefit to the public over single purpose or private uses. Under the current plans and alternative E there are no plan components for key linkage areas that promote wildlife connectivity.

Effects of the Current Plans

Plan components provide direction for the administration of the Custer Gallatin's recreational special uses program. In some cases the current plans provides more site-specific direction than the revised plan alternatives. For example, they set a limit on total number of service days for all outfitter guide use under the Gallatin Forest Plan.

In all alternatives, natural disturbances, recreation use patterns, and emerging technologies would continue to influence the need for recreation special use permits across the Custer Gallatin. Vegetative conditions can seriously impact the location and infrastructure of recreation special uses. Additionally, the condition of aging infrastructure can have effects to permit holders in both the short and long term. Emerging technologies as well as shifts and changes in recreational interests can influence the kinds and location of special uses on the landscape.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

Plan components for the revised plan alternatives do not vary by alternative. Recreation special uses direction includes desired conditions and goals for all permits, then further direction is addressed for outfitter guides, recreation residences, ski areas, recreation events, organizational camps, commercial filming and still photography, and finally noncommercial group use. Specific plan components for outfitter guides contained within the current plans for wilderness are not carried forward in the revised plan alternatives. However, in all revised plan alternatives, plan components limit additional authorized use to the existing levels in wilderness. Permits for recreation events would not be issued for the Buffalo Horn and West Pine Backcountry Areas in any alternative in which they are proposed.

In alternatives B and E, forestwide, a risk assessment of disease transmission to bighorn sheep would be needed prior to issuing new special use permits for outfitter use of pack goats.

Under alternative C, outfitter use of pack goats would be prohibited within the Madison, Henrys Lake, Gallatin Mountain Geographic Area, the Absaroka-Beartooth Geographic Area and the Pryors Geographic Area. In the other geographic areas a risk assessment of disease transmission to bighorn sheep would be needed prior to issuing a permit.

In alternative D, outfitter use of pack goats would be prohibited forestwide.

Effects Common to the Revised Plan Alternatives

As described in the current plans, in all revised plan alternatives, natural disturbances, recreation use patterns, emerging technologies, vegetative conditions, and aging infrastructure would continue to influence the need for recreation special use permits across the Custer Gallatin.

The effect of fewer specific plan components for outfitter guides in wilderness would be added flexibility in specific circumstances, where additional authorizations would contribute to social and ecological conditions in designated wilderness. These plan components also provides a pathway for considering different types of use within the allocated days.

Outfitters currently have not requested use of pack goats. However, if new use was requested under alternative B, C, or E it would require the assessment of risk of disease transmission to bighorn sheep, and this use would be limited to the Sioux, Ashland, and Bridger, Bangtail, Crazy Mountains Geographic Areas in alternative C.

Consequences to Recreation Special Uses from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Watershed, Riparian, and Aquatic Management

All revised plan alternatives provide more detailed direction and guidance than the current plans for the management of recreation special uses to protect watershed, riparian and aquatic habitats, most specifically within riparian management zones. Many special use permits require access to areas located within riparian zones. Where possible new recreation special uses would be located outside of these zones. Plan components for riparian zones may limit road construction and vegetation management activities that could occur in association with special use permits.

Effects from Wildlife Management

For all alternatives, activities related to wildlife improvements and management would affect recreation special uses across the Custer Gallatin National Forest. Most notable is direction for food storage for bears at outfitter guide camps. Construction of new developed recreation sites would be limited within the Greater Yellowstone Area Grizzly Bear Conservation Strategy Recovery Zone boundaries. For all revised plan alternatives, winter wildlife plan components for wolverine could restrict future special use permits, and new groomed winter snowmobile or cross-country ski routes. Also in the revised plan alternatives, the wildlife guideline, written to minimize potential conflicts between grizzly bears and humans inside the recovery zone and primary conservation area, would restrict issuing special use permits for ”activities that involve people traveling by foot, horse or non-motorized vehicle, during the hours between sunset and sunrise. This guideline only applies during the grizzly bear non-denning season of March 1 through November 30.” For all revised plan alternatives, the effect of this would be to limit areas open to issuing permits for 24 hour runs and other such events to places outside of the grizzly bear recovery zone. Given other limitations on recreation events in designated wilderness, recommended wilderness areas, and wilderness study areas, event organizers would be required to obtain a special use permit and would find choices of locations more limited than under the current plans.

Effects of Recommended Wilderness Area and Backcountry Land Allocations

Plan components in all revised plan alternatives for recommended wilderness may have specific effects on various special use permits. New recreation events and construction of new developed recreation facilities would not be authorized in recommended wilderness. This may result in relocation or cancelation of events such as races that have been held permits on the Custer Gallatin for years, as the term of those existing permits expire between one and five years, after which a new permit would be required. Alternative D has over 700,000 acres of recreational emphasis area, the largest amount of all alternatives. Due to this large amount of acres in recommended wilderness in alternative D, there would be much smaller number of remaining areas still open to recreation events, filming locations, as well as communication towers, powerlines, and other special use permitted infrastructure not suitable in recommended wilderness.

In alternatives B and C, prohibiting permitted recreation events in the Buffalo Horn and West Pine Backcountry Areas should reduce wildlife conflicts with large gatherings, and maintains those areas for quiet recreation. Those events would be displaced to other areas of the national forest or to off-forest locations.

Effects from Fire and Fuels Management

Unplanned and prescribed fires would continue to affect the long-term ecological processes across the Custer Gallatin National Forest. Plan components for fire would not stop a temporary loss of vegetation, reduction in water quality due to sedimentation, reduction in recreation access to some areas, and air pollution, which could cause displacement of some forest visitors to other areas on the national forest or to other national forests in the region. However, these effects are part of natural, ecological processes. Fire and fuels plan components envision vegetation conditions that would support low-intensity fire adjacent to infrastructure to reduce negative impacts to values at risk. Fuels could be treated to limit the intensity of fire in areas around locations used under special use permit.

Effects from Permitted Livestock Grazing Management

The revised plan alternatives provide suitability direction for the management of grazing within developed recreation sites. In grazing management, suitable areas are capable areas minus areas chosen to be unacceptable to graze to minimize conflicts with areas such as campgrounds, other developed recreation sites, research natural areas, fenced rights-of-way, or other areas closed by decision. Therefore, when recreation special uses are within a developed setting, livestock grazing would not cause an effect. However, if the special use permit was granted for areas open to grazing, then participants may encounter cattle, fencing, water developments etc.

Effects from Cultural, Historic, and Tribal Resource Management

Many of the recreation residences and resorts on the Custer Gallatin National Forest are historic and have a need to be managed for their historic values in addition to their recreational values. Future expansion and remodeling of these requires additional planning and approval to ensure that historic values are not damaged. All alternatives, including the current plans, provide plan components that would protect and enhance the historic resource values associated with recreation rental cabins, recreation summer homes, and developed recreation facilities.

Cumulative Effects

It is expected that recreational uses on national forest lands will continue to increase, as more people nationwide continue to look for places to recreate. As more people venture onto public lands, differing societal desires and ideas of the recreation opportunities public lands should provide will continue to influence public land management policy.

Developed recreation sites and the dispersed recreational actives offered by the Custer Gallatin National Forest are part of the huge variety of recreational opportunities in the state of Montana, with proportionally much less offered in the South Dakota segment of the Custer Gallatin. The recreational front country opportunities outside of wilderness on the Custer Gallatin are part of a network offered by other public land management agencies. Coordination with other agencies and organizations to provide recreation opportunities would continue to be necessary to meet public demands.

Construction of new developed recreation sites within the recovery zone boundaries would be limited by the Greater Yellowstone Area Grizzly Bear Conservation Strategy. This hinders the ability to provide more capacity for overnight camping in forest areas where population pressures and tourism are expected to increase. There has also been concern that lack of additional overnight developed recreation campsites in popular locations moves campers to dispersed camping, where encounters with bears may be more likely and there are no food storage facilities or other interpretive signing to educate visitors on camping in bear prone areas. Existing mitigation factors in the recovery zone, may allow additional facilities in limited scenarios if the actions benefits bears, such as consolidation or elimination of existing facilities.

Within the assumptions on population growth near the Custer Gallatin, there are some likely limits to the recreational activities offered under special use permit. New locations for ski area developments, resorts, summer camps are not currently proposed. Nationally, there are approximately 14,000 permitted recreation residences on National Forest System lands, and program will not expand due to national direction. Depending on decisions about new recommended wilderness, there may be displacement of some large, traditional recreation events, which may cause organizers to look at other locations, both off Forest Service managed lands or on other national forests.

3.19.8 Conclusion

In the current plans, recreation opportunity spectrum direction would continue to be in different documents and be inconsistent with 2012 Planning Rule direction to incorporate recreation opportunity spectrum into the forest plan.

The recreation opportunity spectrum classifications vary by alternative by the locations of recommended wilderness areas. In alternative E, the recreation opportunity spectrum classification in the wilderness study area reflects the 2006 Gallatin Travel Plan and would allow more motorized opportunity than the current situation or other revised plan alternatives.

Revised plan alternatives map desired recreation opportunity spectrum settings as per the intent of the 2012 Planning Rule. All of the revised plan alternatives would establish guidance and desired recreation opportunity spectrum classes for both summer and winter recreation settings and set expectations for the recreation settings on the Custer Gallatin. Desired recreation opportunity spectrum classes would aid in managing both existing and emerging recreation uses. Setting clear expectations and identifying a spectrum of settings for recreation users is important to the long-term management of recreation use on the Custer Gallatin. Travel plans would continue to provide the site-specific direction for where motorized uses can and cannot occur.

Plan components, in addition to Forest Service manual direction, provide direction to manage the recreation special uses program in conjunction with other forest resources.

The revised plan alternatives plan components provide direction for the management of dispersed recreation, the management of cabin and lookout rentals and to limit the construction of new recreation sites in riparian areas. By providing the plan components outlined in the revised plan alternatives, the Custer Gallatin National Forest would meet the purpose and need of the revised forest plan, ensuring that recreation opportunities are ecologically, economically, and socially sustainable for present and future generations.

3.20 Scenery

3.20.1 Introduction

Scenery provides important sense-of-place backdrops, settings, and character-defining elements that can be valued and enjoyed by forest visitors and people in adjacent communities, contributing their recreation experience. The spectacular scenery of the Custer Gallatin is a national driver for tourism, recreation, and the economy, especially in the Greater Yellowstone Area. The importance of this scenery was emphasized by comments offered during the public forest plan revision meetings, as well as the recognition of how expectations for the scenery represent a range.

While many of the benefits of the national forest scenery are intangible, there are very real quantifiable economic benefits that contribute to local economies and communities. Movies filmed partly on National Forest land or with National Forest land providing a backdrop, such as “A River Runs Through It” and “A Horse Whisperer” produced what the Montana State Film Office (Meyers 2003) referred to as “a stunning love affair with the state.” Another newspaper article entitled “Reflecting on the film “A River Runs Through It” and how it changed Montana” stated “the film boosted the local fly-fishing and real estate industries, attracted tourists to Montana, and drew attention to the state's beauty and beloved rivers" (Flandro 2012).

Regulatory Framework

The National Environmental Policy Act of 1969 (42 U.S.C. 4321): directs the Federal Government to "(2) assure for all Americans . . . healthful, productive, and aesthetically and culturally pleasing surroundings; (3) attain the widest range of beneficial uses of the environment without degradation, [or] risk to health . . .; (4) preserve important historic, cultural, and natural aspects" of our environment. It further directs agencies to "insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on man's environment." This act directs agencies to develop methods and procedures "which will insure that [scenery and other] unquantified environmental amenities and values may be given appropriate consideration in decision making along with economic and technical considerations."

The Wild and Scenic Rivers Act of 1968: stipulates that the outstandingly remarkable scenic values of rivers that are determined to be eligible or suitable for inclusion in the system be managed to avoid negative effects to the scenery of the river corridor.

National Forest Management Act of 1976: directs that the preservation of aesthetic values be analyzed at all planning levels. Part 219.21 requires visual resources to be inventoried and evaluated as an integral part of evaluating alternatives in the forest planning process, addressing both the landscape's visual attractiveness and the public's visual expectation. It also requires that "esthetic" impacts be assessed for projects. In addition, it stipulates "cut blocks, patches, or strips are shaped and blended to the extent practicable with the natural terrain".

Title 36 of the Code of Federal Regulations, Part 219, Subpart A, National Forest System Land and Resource Management Planning (36 CFR part 219, subpart A): regulates the scenic resources of National Forest System lands. Requirements include the consideration, treatment, and protection of intangible resources such as scenery and aesthetics.

Public Rangelands Improvement Act of 1978: states "unsatisfactory conditions on public rangelands reduce the value of such lands for recreational and aesthetic purposes."

The 2012 Land Management Planning Rule: requires the Forest Service to take into account the contribution of the National Forest scenery to the social and economic sustainability of the national forest. The Planning Rule also requires the Forest Service to identify and evaluate existing information relevant to the national forest for sustainable recreation settings and scenic character. Taken together, these requirements direct the Forest Service to evaluate the scenery in such a way that considers the views of National Forest System land for people who are recreating and viewing scenery from inside the national forest as well as for those who are viewing National Forest System land from outside the national forest. This emphasizes the distinction that the National Forest scenery is not solely a component of the recreation experience on the national forest, but a resource that is enjoyed and appreciated by people who are not even visiting the national forest.

Forest Service Manual (FSM) 2380: outlines Forest Service policy and direction for the management of scenic resources. Section 2380.3 describes Forest Service policy with regard to the scenic resources. The four components of the policy are listed below:

- Inventory, evaluate, manage, and, where necessary, restore scenery as a fully integrated part of the ecosystems of National Forest System lands and of the land and resource management and planning process
- Employ a systematic, interdisciplinary approach to scenery management to ensure the integrated use of the natural and social sciences and environmental design
- Ensure scenery is treated equally with other resources
- Apply scenery management principles routinely in all National Forest System activities

Forest Service Manual section 2380.31: requires the use of the basic concepts, elements, principles, and variables defined in Agriculture Handbook 701, Landscape Aesthetics: A Handbook for Scenery Management (USDA Forest Service 1995) referred to as the **scenery management system (SMS**). The scenery management system replaced the 1974 Forest Service visual management system (VMS). Both systems provide systematic approaches for inventorying, analyzing and determining the relative value and importance of national forest scenery. Both systems establish overall scenery goals and objectives for proactive or reactive management and monitoring. The scenery management system retains many of the same basic inventory elements, but introduced some new vocabulary, along with some key concepts:

> The scenery management system recognizes that the landscape and scenery are dynamic, and that especially the vegetative components are affected by a variety of natural disturbance processes such as insects, disease, wind throw, fires, and droughts; and thus, have varied and evolved over time. The scenery management system recognizes that a dynamic landscape creates scenery that is not a static image. This means that the application of the scenic integrity objectives does not relate to a static scenic character description but to a description that considers dynamic and changing landscape processes.

The overall goal of the scenery management system, as well as of the visual management system, is to recognize the value of a natural-appearing national forest landscape. However, the scenery management system recognizes that some human-introduced visual elements in a predominantly natural setting may add value and meaning to the scenic character, such as historic, cultural, agricultural, or ranching-related features (even reservoirs).

Forest Service Handbooks provide guidance for the management of scenic resources are:

- U.S. Department of Agriculture, Forest Service. National Forest Landscape Management, Volume 2:
  - Chapter 5: "Timber" Agriculture Handbook 559.
  - Chapter 4: "Roads" Agriculture Handbook 483
  - Chapter 6: "Fire" Agriculture Handbook 608.
  - Chapter 8: "Recreation" Agriculture Handbook 666.
  - Chapter 2: “Utilities” Agriculture Handbook 478.

Key Indicators and Measures

The key indicators for analyzing the alternatives are the scenic integrity objectives (SIOs), as displayed in the maps and the acreage tables for the different alternatives. It is important to understand that while SIOs incorporate the word “objective,” the SIOs almost always serve as thresholds of allowable visual dominance created by new landscape modifications or disruptions that contrast with or detract from the valued scenic character, in terms of line, form, color, texture, pattern, harmony, size, and scale.

Methodology and Analysis Process

The scenic integrity objectives in each of the alternatives analyzed here were determined by following the process described by Forest Service Handbook 701, the Scenery Management System.

- Scenic character descriptions were developed for each geographic area based upon field visits. Those are included in the final scenery assessment report (Ruchman 2017).
- Inherent scenic attractiveness ratings for all Custer Gallatin National Forest landscapes were determined and mapped, based upon field visits, satellite aerial photos, and the methodology described in the Agriculture Handbook 701. Refer to the final scenery assessment report (Ruchman 2017) for more details, descriptions, and maps.
- Viewsheds and critical viewing platforms (travelways and viewpoints) were prioritized through internal and public discussions, including through a series of public meetings at multiple locations across the region served by the Custer Gallatin.
- Scenic Classes were developed through a GIS modeling process that overlaid the above information.
- Scenic integrity objectives, from very high to very low, for each alternative were developed based upon the scenic classes along with other resource and mission issues.

The scenic integrity objectives proposed for each alternative assume that the vegetation would continue to be affected by various factors such as fire, insects, drought, and disease and that the wildland urban interface areas would continue to expand and become more developed, which may increase the need to address fuels and may impact overall viewsheds.

Figure 59. Example of very high scenic integrity level where there are only minute, if any, deviations from the scenic character (photo in the Absaroka Beartooth Wilderness character)

Figure 60. Example of high scenic integrity level where deviations are not evident and do not dominate the scenic character (photo of the Beartooth Scenic Byway and the Rock Creek drainage)

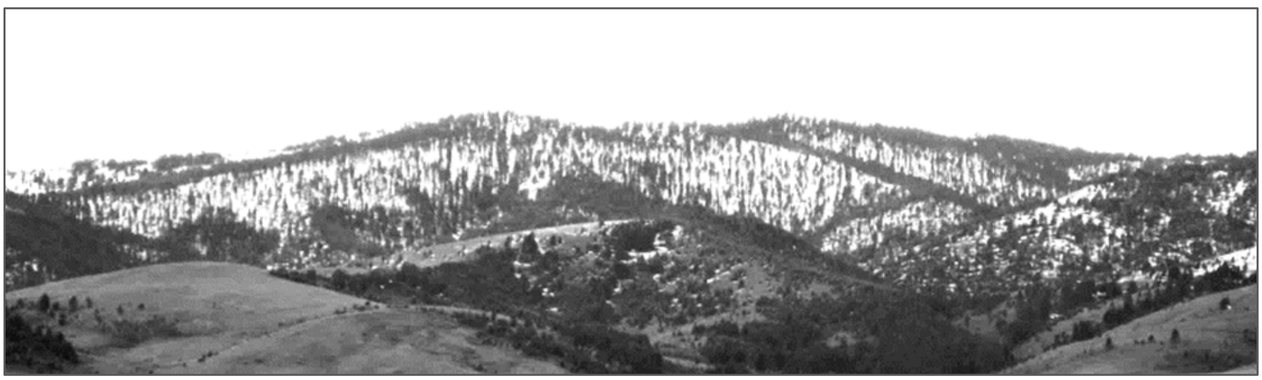

Figure 61. Example of moderate scenic integrity level where the landscape appears slightly altered, deviations must remain visually subordinate to the scenic character (photo in the Madison Mountains)

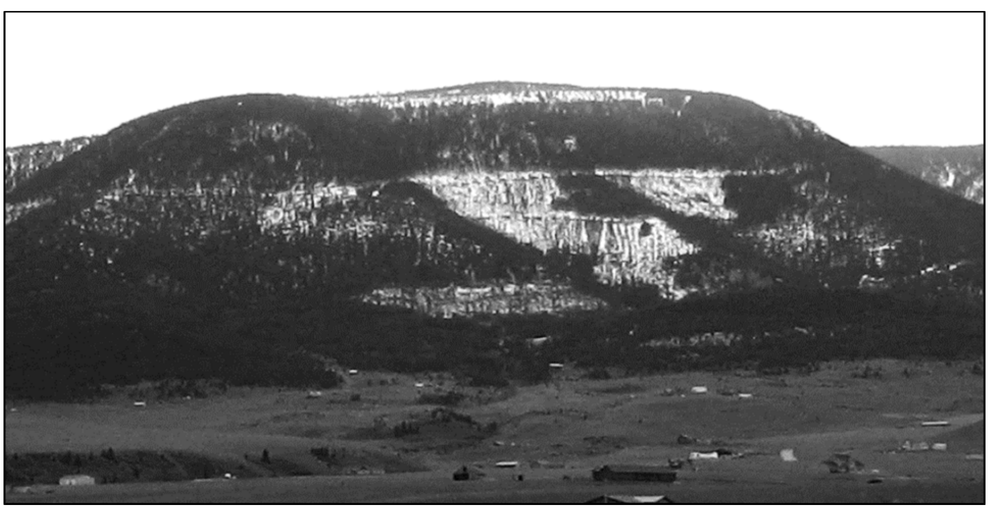

Figure 62. Example of Low scenic integrity – where the landscape appears altered, deviations begin to dominate the scenic character (photo in the north end of the Gallatin Range)

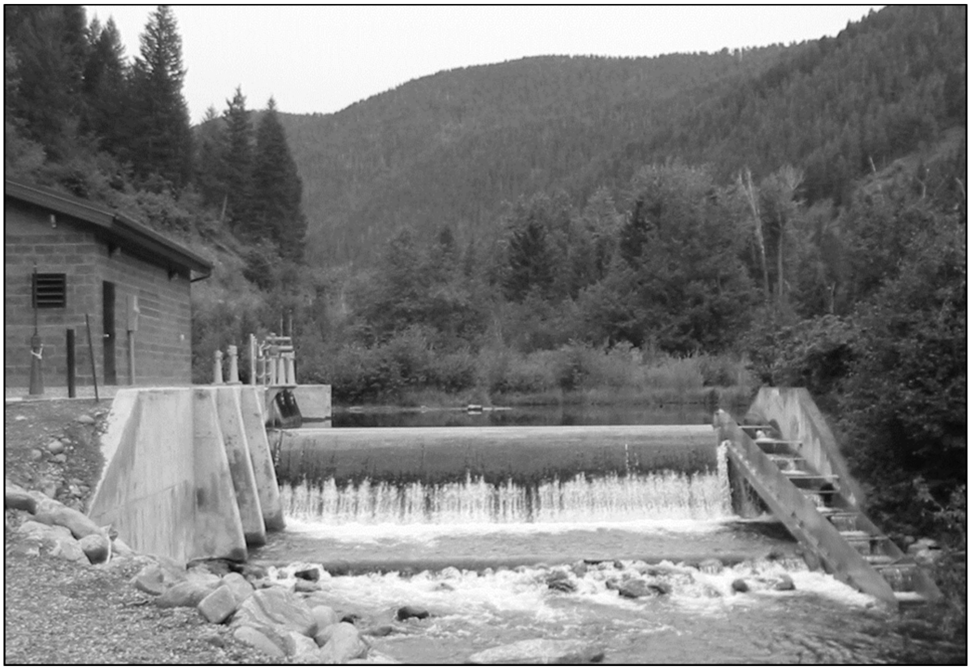

Figure 63. Example of Very Low scenic integrity – where the landscape appears heavily altered, deviations may strongly dominate (photo in the north Gallatin Mountains)

Information Sources

The Forest Service scenery management system information, assumptions, and process guided the development of the forestwide scenic integrity objectives in the alternatives and the plan components for the revised Forest Plan. Existing geographic information system (GIS) layers were used for information such as locations of National Forest trails, roads, recreation sites, State and County roads, and communities. That system is described in more detail in the "Regulatory Framework" section of this report.

Analysis Area

The area analyzed includes all land and viewsheds within the Custer Gallatin National Forest as well as viewsheds in which Custer Gallatin National Forest land is visible from viewing platforms located on neighboring non-National Forest land. This area applies to the analysis for indirect, direct, and cumulative effects. The temporal scope is the anticipated life of the plan.

3.20.2 Affected Environment (Existing Condition)

Scenic Character

The affected environment for the scenery resource is partly portrayed by a description of the scenic character. The 2012 Planning Rule defines scenic character as "a combination of the physical, biological, and cultural images that gives an area its scenic identity and contributes to its sense of place. Scenic character provides a frame of reference from which to determine scenic attractiveness and to measure scenic integrity." For the Custer Gallatin National Forest one overall scenic character description is inadequate because from west to east, the Custer Gallatin National Forest sweeps across roughly 450 miles. The Custer Gallatin has an incredible diversity of landscapes, from high alpine, glacially-scoured peaks and lakes, across the valleys of southwestern and south-central Montana to buttes, dramatically eroded cliffs, pine savannas, and rolling prairie grasslands of eastern Montana and northwestern South Dakota. Across the entire forest, the vegetation has been, and continues to be, affected by a variety of natural elements, from large fires to entire stands of trees killed by insects. The final scenery assessment report (Ruchman 2017) provides scenic character descriptions for each geographic area.

The scenic character also incorporates a description of the context and ways the scenery is viewed and experienced, as well as associations that viewers have based upon visible historic elements, such as the Historic OTO Dude Ranch and the Historic Main Boulder Ranger Station. Other visual elements are recognized nationally for their outstanding scenery, such as the Beartooth National Forest Scenic Byway, also awarded All American Road status, and the Continental Divide National Scenic Trail. Topography plays an important role in how viewers experience the scenery of the Custer Gallatin National Forest. In the Greater Yellowstone Area, (from West Yellowstone to Red Lodge), the Custer Gallatin National Forest land is comprised of some major mountain ranges, steep ridges, hillsides, and peaks. All of these features are visible from numerous vantage points outside the Custer Gallatin and help define the striking setting and sense of place enjoyed by neighboring residents and visitors. In the Ashland and Sioux geographic areas, the topography of the Custer Gallatin National Forest is more subtle and not as frequently or easily visible from the surrounding small communities and ranchlands. Regardless, across the Custer Gallatin, residents and other viewers care about the national forest scenery, as viewed from within and from outside, and have articulated and prioritized those viewing platforms felt to be most critical. See Management Approaches, Appendix A of the Custer Gallatin Draft Revised Plan, for the list of critical viewing platforms.

Inherent Scenic Attractiveness

Inherent scenic attractiveness is a classification of how visually unique, distinctive, and thus valued, specific scenery is. Inherent scenic attractiveness refers to enduring visual qualities of the landscape that do not generally change, even as elements, such as an unusually large fire may change the scenic character; or roads, mines or timber harvest may lower the condition of the scenery. Inherent scenic attractiveness ratings are based upon commonly held perceptions of beauty related to land forms and rock features, vegetation patterns and composition, water features and their characteristics, along with concepts such as uniqueness, variety (including seasonal), mystery, and vividness of the line, form, color and texture of the scenery. Sometimes positive cultural features, such as log cabins, fences, historic mining features, or ghost towns that have become valued over time add to the inherent scenic attractiveness.

To avoid comparing the more subtle beauty of Ashland or Sioux Districts’ pine savanna landscapes to more overtly spectacular alpine scenery of the Absaroka Beartooth, Madison, or Crazy Mountains, inherent scenic attractiveness ratings were conducted within ecological land units, of which the Custer Gallatin National Forest spans three. For more details about the geographic frames of reference used to determine the inherent scenic attractiveness ratings and to see the mapped ratings, the final scenery assessment report (Ruchman 2017). The distribution of inherent scenic attractiveness across the Custer Gallatin is shown in table 136.

Table 136. Inherent scenic attractiveness in acres and percent of each geographic area[1]

Geographic Area	A – Distinctive Areas of unusual visual attributes of vividness, patterns, unique or outstanding variety of rock, water, topo and vegetation forms	B – Typical Areas that provide positive yet common vividness, patterns and rock, water, topo and vegetation forms	C – Indistinctive Landscapes with little to no visual variety, uniqueness or vividness in rock, water, topo or veg forms,
Sioux	137,286 acres 83 percent	27,173 acres 17 percent	0 acres 0 percent
Ashland	236,453 acres 54 percent	164,415 acres 38 percent	35,265 acres 8 percent
Pryor Mountains	51,665 acres 69 percent	19,548 acres 26 percent	3,853 acres 5 percent
Absaroka Beartooth Mountains	768,415 acres 57 percent	548,246 acres 40 percent	36,634 acres 3 percent
Bridger Bangtail Crazy Mountains	49,663 acres 24 percent	125,762 61 percent	296,606 14 percent
Madison, Henrys Lake, Gallatin Mountains	209,670 acres 18 percent	446,622 acres 62 percent	150,107 acres 20 percent
Forestwide Totals	1,445,705 acres 48 percent	1,338,205 acres 44 percent	255,465 acres 8 percent

1. Acres are based upon hand digitized one half inch = 1 mile 1980s hand-drawn maps. Acres for land lost or acquired since then are not included.

Existing Scenic Integrity (Existing Condition)

Existing scenic integrity refers to the current condition of the scenery as it has been influenced or changed by human modifications or constructed features, such as roads, mines, or timber harvest, that are generally not considered to be valued components of the forest scenery. Existing scenic integrity indicates the degree of intactness and wholeness of the landscape character, or conversely, it measures the degree of visible disruption.

The most recent comprehensive assessment of the existing scenic integrity for both the Custer National Forest and the Gallatin National Forest was done at a very coarse scale for the entire Forest Service Northern Region in 2010. It was entirely a geographic information System-generated product, with no ground verification, using available data at the time that has not been verified on the ground from key observation travel routes and points. The resulting product rated the existing scenic integrity of the scenery on National Forest System land at the time into one of five levels: very high, high, moderate, low, and unacceptably low. For more detailed information about that process and the factors it considered and protocols it applied, refer to the final scenery assessment report (Ruchman 2017). Forestwide results from that analysis are shown in the table below.

Table 137. Existing scenic integrity for the Custer Gallatin National Forest

Existing Scenic Integrity (existing condition of the scenery)	Acres of National Forest Land in 2010[1]	Percent of National Forest Land (2016 acreage)
Very High: Scenery appears unaltered	1,035,675	34
High: Scenery appears unaltered and any visual disturbances are unnoticed	1,761,614	58
Moderate: Scenery appears slightly altered but any disturbances are visually subordinate	58,566	2
Low: Scenery appears moderately altered and disturbances may start to dominate.	180,797	6
Unacceptably Low	0	0
Totals	3,036,652	100

1. Acres were based upon very coarse 2010 Regional-level parameters. Levels were not verified from viewpoints on the ground. Acres do not include lands lost or acquired since that time.

On-the-ground monitoring shows that some of the most obvious visual disruptions that had locally lowered the scenic integrity, have now improved through time or through restoration efforts. Examples of notable, extensive, and successful restoration work include the New World Mining District (northeast of Cooke City, in the Absaroka Beartooth geographic area), the extensive on-going Riley Pass reclamation work in the North Cave Hills Unit of the Sioux geographic area, and restoration of 1980s cable-harvest clearcuts, visible to the south from many parts of the Gallatin Valley in the north end of the Gallatin Mountains.

3.20.3 Environmental Consequences

Current Plans

Management Direction under the Current Plans

The current forest plans followed the information and process described by the Forest Service visual management system to manage the scenery resource.

Under the current Gallatin National Forest Plan, all National Forest land was assigned a visual quality objective that had been derived from a visual management inventory.

Table 138 shows the acreage for the visual quality objectives assigned by the Gallatin National Forest Plan. This table also shows the comparable scenic integrity objectives of the scenery management system terminology.

Under the current Custer National Forest Plan, a full visual management system inventory was not conducted and visual quality objectives were not assigned to National Forest land. Instead, the Custer National Forest Plan assigned a range of visual quality objectives to each management area, and directed that any proposed projects go through a project-specific analysis to determine the appropriate project area visual quality objectives. Some management areas that comprise specific land allocations such as wilderness, the Beartooth Scenic Byway and the National Natural Landmarks were assigned a single visual quality objective. The Custer National Forest Plan included management standards regarding scenery for certain specific activities such as minerals and geology (regarding selecting locations and using earth tone colors) and timber production and overhead power poles (minimizing visual impacts). For the Beartooth Scenic Byway, the Custer National Forest Plan assigned the visual quality objective of "retention" to all areas seen from the Byway, excluding the highly developed recreation area along the creek. For management areas where mining activities were either anticipated or already ongoing, the forest plan incorporated a stipulation that the scenery objectives were "subject to valid existing rights".

Table 138. Current Gallatin National Forest Plan visual quality objectives (definitions and acres) along with the newer, comparable scenery management system (SMS) terminology

Visual Quality Objectives and Definitions	Total acres for Gallatin National Forest Land in 1987	Crosswalk to comparable SMS scenic integrity objectives
Preservation: Only ecological changes are allowed to alter the natural landscape.	747,771 acres = 44% of the Gallatin National Forest in 1987 This applies to designated Wilderness areas.	Very High: landscape character is intact with only minute if any deviations
Retention: Human activities are not evident to the casual Forest visitor.	385,267 = 22% of the Gallatin National Forest in 1987	High: Deviations are not evident, do not dominate the scenic character
Partial Retention: Human activities may be evident, but must remain subordinate to the characteristic landscape.	397,370 acres = 23% of the Gallatin National Forest in 1987	Moderate: appears slightly altered, deviations must remain visually subordinate to the scenic character
Modification: Human activity may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in the middle-ground or background.	167,874 acres = 9% of the Gallatin National Forest in 1987	Low: appears altered, deviations begin to dominate the scenic character
Maximum Modification: Human activity may dominate the characteristic landscape, but should appear as natural when viewed as background.	4,657 acres = <1% of the Gallatin National Forest in 1987 This applies to the New World and East Boulder mining areas.	Very Low: appears heavily altered, deviations may strongly dominate

Because of the differences between visual management approaches of the current Custer and the Gallatin National Forest Plans, it is not possible to display the existing total acres and percentages of the Visual Quality Objectives for the entire, now-combined Forest.

Effects of the Current Plans

In the current plans, the National Forest scenery and visual impacts of new projects would continue to be managed using the visual management direction in the existing Custer and Gallatin forest plans. This would not be consistent with the purpose and need of having a consistent approach to scenery management across the Custer Gallatin National Forest. It would also make future planning more difficult because every time a project is initiated on the former Custer side of the national forest, a scenery inventory and an appropriate project-specific visual quality objective would need to be determined.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

The distribution of the scenic integrity objectives in the revised plan alternatives reflects a range in priorities across the Custer Gallatin, from viewsheds where managing and maintaining the scenic integrity is most important, to areas where achieving other goals or meeting other resource values may be a higher priority. The assigned scenic integrity objectives vary across alternatives only due to the different locations and amounts of recommended wilderness, where the scenic integrity objective of very high is assigned.

Scenery guidelines provide direction related to the viewing platforms from where scenic integrity objectives should be applied and the timeframes in which to achieve the objectives. In addition, specific guidance is provided for:

- scenery management in developed recreation sites and in research natural areas,
- scenery management for new permitted livestock grazing activities in wilderness and recommended wilderness, and
- thresholds for deviation from scenic integrity objectives for new hard rock mining activities associated with valid existing rights.

Effects Common to all Revised Plan Alternatives

The scenic integrity objectives proposed in all of the revised plan alternatives, along with the other plan components for scenery, would provide management direction for all new activities that modify the landscape, including installation of facilities such as utility lines, mining facilities, administrative or recreation facilities, or roads, as well as vegetation management such as fuel reduction or timber harvest.

Specifically, the assigned scenic integrity objectives and the associated plan components that structure the application of the scenic integrity objectives would serve to maintain and manage for the condition of the scenery in a sustainable way that reflects the relative value, importance, and viewing context of all the Custer Gallatin National Forest land, as well as the dynamic nature of vegetation over time.

However, for minerals projects associated with valid exiting or statutory rights, negative impacts to the scenic integrity may result where mitigations to meet the assigned scenic integrity objective are considered technically or economically infeasible.

As such, the scenic integrity objectives and associated plan components would not directly prohibit any on-the-ground work, but may influence the design or the location of projects to meet or exceed the lowest allowable level of scenic integrity. The scenic integrity objective of very low is not assigned to any land areas in any of the revised plan alternatives.

Effects of Alternative B

The scenic integrity objectives would be assigned to National Forest land as shown in the following tables (table 139 for the entire national forest, and table 140 broken out by geographic area). The locations of the assigned scenic integrity objectives are shown in Appendix A.

Table 139. Alternative B scenic integrity objectives (lowest allowable scenic integrity levels) forestwide

Forestwide scenic integrity objectives (lowest allowable levels)	Acres	Percent of Custer Gallatin National Forest land
Very High	1,157,885	38
High	63,958	2
Moderate	1,377,814	45
Low	439,612	14
Very Low	0	0

Table 140. Alternative B scenic integrity objectives (lowest allowable scenic integrity levels) by geographic area, acres and percent of geographic area

Geographic area scenic integrity objectives (lowest allowable levels)	Very High	High	Moderate	Low	Very Low
Sioux	0 acres 0 percent	6,276 acres 4 percent	79,893 acres 49 percent	78,290 acres 48 percent	0 acres 0 percent
Ashland	0 acres 0 percent	0 acres 0 percent	291,696 acres 67 percent	144,428 acres 33 percent	0 acres 0 percent
Pryor Mountains	6,804 acres 9 percent	11,928 acres 16 percent	52,198 acres 70 percent	4,136 acres 6 percent	0 acres 0 percent
Absaroka Beartooth Mountains	915,658 acres 68 percent	34,200 acres 3 percent	351,652 acres 26 percent	51,770 acres 4 percent	0 acres 0 percent
Bridger, Bangtail, Crazy Mountains	0 acres 0 percent	0 acres 0 percent	163,968 acres 80 percent	41,056 acres 20 percent	0 acres 0 percent
Madison, Henrys Lake, Gallatin Mountains	235,422 acres 29 percent	11,554 acres 1 percent	438,407 acres 54 percent	119,932 acres 15 percent	0 acres 0 percent

Effects of Alternative C

The scenic integrity objectives would be assigned to National Forest land as shown in the following tables: table 141 for the entire national forest, and table 142 broken out by geographic area. The locations of the assigned scenic integrity objectives are shown in Appendix A.

Table 141. Alternative C scenic integrity objectives (lowest allowable scenic integrity levels) forestwide

Forestwide Scenic Integrity Objectives (lowest allowable levels)	Acres	Percent of Custer Gallatin National Forest land
Very High	1,190,558	39
High	63,287	2
Moderate	1,352,598	45
Low	432,823	14
Very Low	0	0

Table 142. Alternative C scenic integrity objectives (lowest allowable scenic integrity levels) by geographic area, acres and percent of geographic area

Geographic area scenic integrity objectives (lowest allowable levels)	Very High	High	Moderate	Low	Very Low
Sioux	0 acres 0 percent	6,276 acres 4 percent	79,893 acres 49 percent	78,290 acres 48 percent	0 acres 0 percent
Ashland	0 acres 0 percent	0 acres 0 percent	291,696 acres 67 percent	144,428 acres 33 percent	0 acres 0 percent
Pryor Mountains	6,804 acres 9 percent	11,928 acres 16 percent	52,198 acres 70 percent	4,134 acres 6 percent	0 acres 0 percent
Absaroka Beartooth Mountains	915,658 acres 68 percent	33,529 acres 2 percent	351,875 acres 26 percent	52,218 acres 4 percent	0 acres 0 percent
Bridger, Bangtail, Crazy Mountains	0 acres 0 percent	0 acres 0 percent	163,968 acres 80 percent	41,056 acres 20 percent	0 acres 0 percent
Madison, Henrys Lake, Gallatin Mountains	268,096 acres 33 percent	11,554 acres 1 percent	412,968 acres 51 percent	112,697 acres 14 percent	0 acres 0 percent

Effects of Alternative D

The scenic integrity objectives would be assigned to National Forest land as shown in the following tables: table 143 for the entire forest, and table 144 broken out by geographic area. The locations of the assigned scenic integrity objectives are shown in Appendix A.

Table 143. Alternative D scenic integrity objectives (lowest allowable scenic integrity levels) forestwide

Forestwide Scenic Integrity Objectives (lowest allowable levels)	Acres	Percent of Custer Gallatin National Forest land
Very High	1,731,872	57
High	30,931	1
Moderate	907,463	30
Low	369,003	12
Very Low	0	0

Table 144. Alternative D scenic integrity objectives (lowest allowable scenic integrity levels) by geographic area, acres and percent of geographic area

,Geographic area scenic integrity objectives (lowest allowable levels)	Very High	High	Moderate	Low	Very Low
Sioux	0 acres 0 percent	6,276 acres 4 percent	79,893 acres 49 percent	78,290 acres 48 percent	0 acres 0 percent
Ashland	38,882 acres 9 percent	0 acres 0 percent	255,607 acres 59 percent	141,635 acres 32 percent	0 acres 0 percent
Pryor Mountains	44,043 acres 59 percent	992 acres 1 percent	27,131 acres 36 percent	2,901 acres 4 percent	0 acres 0 percent
Absaroka Beartooth Mountains	1,126,388 acres 83 percent	17,229 acres 1 percent	178,763 acres 13 percent	30,900 acres 2 percent	0 acres 0 percent
Bridger, Bangtail, Crazy Mountains	92,415 acres 45 percent	0 acres 0 percent	82,163 acres 40 percent	30,446 acres 15 percent	0 acres 0 percent
Madison, Henrys Lake, Gallatin Mountains	430,145 acres 53 percent	6,434 acres 1 percent	283,906 acres 35 percent	84,831 acres 11 percent	0 acres 0 percent

Effects of Alternative E

The scenic integrity objectives would be assigned to National Forest land as shown in the following tables: table 145 for the entire forest, and table 146 broken out by geographic area. The locations of the assigned scenic integrity objectives are shown in Appendix A.

Table 145. Alternative E scenic integrity objectives (lowest allowable scenic integrity levels) forestwide

Forestwide scenic integrity objectives (lowest allowable levels)	Acres	Percent of Custer Gallatin National Forest land
Very High	1,047,870	34
High	66,358	2
Moderate	1,483,221	49
Low	441,830	15
Very Low	0	0

Table 146. Alternative E scenic integrity objectives (lowest allowable scenic integrity levels) by geographic area, acres and percent of geographic area

Geographic area scenic integrity objectives (lowest allowable levels)	Very High	High	Moderate	Low	Very Low
Sioux	0 acres 0 percent	6,276 acres 4 percent	79,893 acres 49 percent	78,290 acres 48 percent	0 acres 0 percent
Ashland	0 acres 0 percent	0 acres 0 percent	291,696 acres 67 percent	144,428 acres 33 percent	0 acres 0 percent
Pryor Mountains	0 acres 0 percent	13,527 acres 18 percent	57,403 acres 76 percent	4,136 acres 6 percent	0 acres 0 percent
Absaroka Beartooth Mountains	914,056 acres 68 percent	35,001 acres 3 percent	350,023 acres 26 percent	54,200 acres 4 percent	0 acres 0 percent
Bridger, Bangtail, Crazy Mountains	0 acres 0 percent	0 acres 0 percent	163,968 acres 80 percent	41,056 acres 20 percent	0 acres 0 percent
Madison, Henrys Lake, Gallatin Mountains	133,814 acres 17 percent	11,554 acres 1 percent	540,227 acres 67 percent	119,720acres 15 percent	0 acres 0 percent

Consequences to Scenery from Forest Plan Components Associated with Other Resource Programs or Management Activities

Effects from Watershed, Riparian, and Aquatic Management

The revised plan alternatives provide more detailed guidance than the current plans for protection of watersheds, riparian areas, and aquatic habitats. Plan components aimed at protecting watersheds and reducing sedimentation complement scenery goals. They usually affect scenic integrity positively in the long term, especially where the implementation would involve closing roads or restoring wetlands that degrade scenic integrity in critical viewsheds.

Effects from Timber and Forested Vegetation Management

The plan components in the revised plan alternatives have detailed desired condition descriptions aimed at maintaining resilience, sustainability, and diversity; whereas the existing plan components in the current plans include sustainability as a general goal, but are not as specific as to how to achieve it. A number of plan components in the revised plan alternatives are complimentary with desired conditions for scenery, such as maintaining old growth, large tree structure and meadows that are open and clear of conifer encroachment. A timber management standard in the revised plan alternatives clearly state that silvicultural treatments would not be based solely on economic or timber output and that timber harvests units would be shaped and blended as much as possible with the terrain.

The exception in the revised plan alternatives to the restocking standard that allows for openings for scenic vistas is consistent with the goal of contributing to the enjoyment of the scenery by forest and area visitors, as long as the operational remnants, such as stumps, slash, edge treatments, and shapes of the openings are consistent with the scenic integrity objectives.

In contrast to the current plans, the revised plan alternatives allow exceptions to the maximum opening size of 40 acres and do not consider existing natural openings as part of the 40 acres. Depending upon the viewing context and areas adjacent to a proposed unit, new openings may be designed to meet scenery goals, such as to visually flow into existing adjacent openings to replicate natural patterns or appear to have occurred naturally.

Effects from Fire and Fuels Management

The fire and fuels management plan components in the revised plan alternatives are complementary with scenery management, including the guideline to use utilize minimum impact suppression techniques in critical viewsheds. In contrast, there is no mention of this in in the current plans.

Effects from Recreation Management

In all alternatives, the recreation opportunity spectrum classes are complementary with scenery management. The recreation opportunity spectrum descriptors of the visible degree of naturalness apply only to the immediate recreation settings for someone on National Forest System land, thus in some areas, they may require a higher or lower degree of naturalness than required by scenery management components.

Recreation opportunity spectrum also complements scenery management in terms of the visual appearance of recreation sites such as campgrounds or resorts, however the recreation opportunity spectrum applies to what recreationists experience and see within recreation sites themselves, including: the materials, colors, density and type of facilities and signage. The scenery management plan components generally apply to how the surrounding foreground, middleground and background National Forest System land appears as well as how recreation sites appear to viewers from a distance.

Effects from Land Allocation

In all alternatives, allocating some areas as recommended wilderness and backcountry areas (low development areas in the current plans) would most likely mean that management would be more directed at sustaining natural processes. This may result in natural dynamic elements that can visibly affect vegetation, such as fire, insects and disease, becoming more evident across the scenery. This would just represent a change in the vegetation component of the scenic character and is neither a positive nor negative effect in terms of scenery.

Areas allocated as recreation emphasis areas in the revised plan alternatives may ultimately host more users, who may end up being vectors of scenery modifications in the viewing foreground, such as soil compaction and social trails, along with the transitory, but consistent increase in visible numbers of people and vehicles. Targeted vegetation management (such as maintaining the overstory for shade and some structures for site privacy) may become more discernible in recreation emphasis areas to provide for more user safety and sustainability of recreation settings. This may mean that vegetation plantings, revegetation, hazard tree removal, cyclical overstory replacement, and fuel management may become more visible and common. More recreation facilities to accommodate increased use may also become more visible and in places, visually dominant. However, because this would be part of the expected view by visitors within concentrated parts of the recreation emphasis areas, this would be consistent with scenery management.

Effects from Wildlife Management

Plan objectives to improve wildlife habitat would have little to no negative effect on scenic integrity. In all alternatives, restoration of aspen can have a positive long-term effect on scenery because aspen stands add variety, visual interest, and exciting seasonal color to the scenery. Habitat restoration that involves removing conifers would need to incorporate design features necessary to meet or exceed the assigned scenic integrity objectives (lowest allowable scenic levels) from the critical viewing platforms, appropriate to each viewing context, setting and vegetation types.

Effects from Minerals Management

In all alternatives, reclamation plans are required for new mineral and energy management activities, and the Forest Service works to reclaim areas of past mining activity. The minerals desired condition in the revised plan alternatives, states that abandoned mine lands and areas impacted by past mining are returned to a pre-mining state, is complementary with and beneficial to scenery management. Also complementary with scenery goals is the revised plan alternatives minerals standard that requires new mineral and energy management activities to be authorized only when the reclamation plan is sufficient to return the site to pre-operational site conditions or to conditions comparable to adjacent lands. This is especially important for scenery where new developments would be visible from critical viewing platforms.

However, in all alternatives, negative impacts to the scenic integrity may result where valid existing rights are involved and mitigations to meet the assigned scenic integrity objectives are considered unreasonable.

Cumulative Effects

Except when viewers are well inside the national forest boundary, viewing only Custer Gallatin National Forest land, viewsheds often include land that is not Custer Gallatin National Forest land. Because the scenery experienced by viewers is not compartmentalized by land ownership or the managing entities, viewers’ experience of Custer Gallatin National Forest scenery may be affected by land that is next to, in front of, or behind National Forest land. Where Custer Gallatin National Forest land is viewed interspersed with private land or land managed by other public entities, actions on that other land can positively or negatively affect National Forest System land. This is addressed by the guideline that recognizes that the National Forest scenery is often viewed as part of an overall viewshed.

Land adjacent to Custer Gallatin National Forest includes land that is managed or owned by various entities, including other national forests, MT State, municipalities, such as City of Bozeman, Bureau of Land Management, National Park Service, and private entities. All of these entities may manage scenery differently than the Custer Gallatin National Forest. Therefore, visitors may perceive a difference in the scenic quality among the different jurisdictions. As private land becomes more and more developed in the foreground and middleground, viewsheds that are currently fairly natural appearing now may become more visibly fragmented and encroached. In the Greater Yellowstone Area, this includes some of the fastest-growing counties in the country where residential growth is booming.

Current, past, and reasonably foreseeable actions on land adjacent to Custer Gallatin National Forest land that could cumulatively impact scenery or projects on Custer Gallatin National Forest land include the following:

- Residential Development. Increasing residential development especially in areas that appear adjacent to or mistakably part of the National Forest. Examples of activities that could negatively impacts scenery include roads, colorful houses, lights visible at night, and sun reflecting on windows and other surfaces.
- Fuel reduction. As the wildland urban interface becomes more developed, owners may implement more actions to reduce fuels around their structures and other investments, further reducing the visual buffer of what is now forested land.
- Timber harvest. Land owners or managers may harvest trees for a variety of reasons, using a variety of harvest techniques.

Other activities such as mineral, oil and gas extraction, communication towers, wind or solar energy generation, and roads may negatively affect viewsheds in which there is National Forest System land.

Given these past, present, and reasonably foreseeable actions, combined with the proposed forest plan direction, the Custer Gallatin National Forest land would still provide an overall scenic backdrop and sense of place as viewed from surrounding communities and travelways, and a pleasing visual setting for visitors that meets general expectations.

Conclusion

The current plans would not resolve the reasons for needing to change scenery management across the Custer Gallatin because there would be still be an inconsistent and unpredictable approach to scenery management and neither of the two existing approaches comply with current Forest Service directives.

All of the revised plan alternatives would resolve the need for change and would meet the 2012 Land Management Planning Rule requirements to take into account the contribution of the National Forest scenery to the social and economic sustainability of the Custer Gallatin. All of the revised plan alternatives, the mapped scenic integrity objectives, and the forest plan components would result in the Custer Gallatin’s scenery being managed in a way that recognizes the public’s expectations and desire to enjoy the scenery, especially in critical viewsheds and would allow for managing for scenic sustainability, within the context of dynamic landscapes.

A comparison of the scenic integrity objectives proposed in the revised plan alternatives show how they generally vary from alternative to alternative based upon the amount and locations of recommended wilderness (table 147). Alternative D has the most amount of land assigned a scenic integrity objective of very high and alternative E has the least. This difference corresponds to the greater amount of land recommended as wilderness in alternative D and none in alternative E. Except for differences among the revised plan alternatives regarding the amount and locations of recommended wilderness with a scenic integrity objective of very high, the assignments of all of the other remaining scenic integrity objectives are the same across all of the revised plan alternatives. No land in any of the revised plan alternatives was assigned a scenic integrity objective of very low.

Table 147. Percent of scenic integrity objectives (SIOs) in the revised plan alternatives (lowest allowable scenic integrity level) by geographic area and forestwide (rounded to whole number)

Geographic area	SIO	Alternative B	Alternative C	Alternative D	Alternative E
Sioux	Very High High Moderate Low Very Low	0 4 49 48 0	0 4 49 48 0	0 4 49 48 0	0 4 49 48 0
Ashland	Very High High Moderate Low Very Low	0 0 67 33 0	0 0 67 33 0	9 0 59 32 0	0 0 67 33 0
Pryor Mountains	Very High High Moderate Low Very Low	9 16 70 6 0	9 16 70 6 0	59 1 36 4 0	0 18 76 6 0
Absaroka Beartooth Mountains	Very High High Moderate Low Very Low	68 3 26 4 0	68 2 26 4 0	83 1 13 2 0	68 3 26 4 0
Bridger, Bangtail, Crazy Mountains	Very High High Moderate Low Very Low	0 0 80 20 0	0 0 80 20 0	45 0 40 15 0	0 0 80 20 0
Madison, Henrys Lake, Gallatin Mountains	Very High High Moderate Low Very Low	30 1 54 15 0	33 1 53 14 0	54 1 35 10 0	17 1 67 15 0
Total percentages for the entire forest (rounded to whole numbers)	Very High High Moderate Low Very Low	38 2 45 14 0	39 2 45 14 0	57 1 30 12 0	34 2 49 15 0

3.21 Designated Areas

3.21.1 Introduction

The term "designated area" refers to a specific area on a landscape that has been established by statute, regulation, or policy. Once established, the designation continues until a subsequent decision by the appropriate authority removes the designation. Designated areas within the Custer Gallatin National Forest have been given permanent designation to maintain their unique special character or purpose. Some designated areas were established by statute or law while others were established through other administrative processes. Certain purposes and restrictions are usually established for designated areas, particularly for those areas that have been designated by law.

This section analyzes the effects of a range of alternatives to current designated areas. The following existing designated areas are covered in this section:

- designated wilderness areas
- wilderness study areas
- Cabin Creek Recreation and Wildlife Management Area
- inventoried roadless areas
- designated wild and scenic rivers
- research natural areas
- special areas
- national natural landmarks
- Pryor Mountain Wild Horse Territory
- Earthquake Lake Geologic Area
- Continental Divide National Scenic Trail
- Nez Perce National Historic Trail
- national recreation trails
- Beartooth National Scenic Byway/All American Road

Regulatory Framework

Wilderness Act of September 3, 1964 (16 U.S.C. 1131-1136): provides the statutory definition of wilderness and management requirements for these congressionally designated areas. The act established a National Wilderness Preservation System to be administered in such a manner as to leave these areas unimpaired for future use and enjoyment as wilderness.

National Forest Management Act of 1976, as amended (16 U.S.C. 1600): provides that management direction for wilderness be incorporated into forest plans and sets minimum standards for the content of the plans.

Forest Service Manual 2320: provides direction for the management of wilderness.

2012 Planning Rule (36 CFR 219.7): states that in developing a proposed plan revision, the responsible official shall identify existing designated areas and determine whether to recommend any additional areas for wilderness designation. Forest plans must include components for appropriate management of existing or proposed designated areas.

36 CFR Part 219 sec. 219.7: requires (during revision) the identification and evaluation of lands that may be suitable for inclusion in the National Wilderness Preservation System.

36 CFR Part 251 sec. 23: requires the identification and evaluation of lands that may be suitable for inclusion in the research natural area system.

36 CFR 293: Wilderness-primitive areas: defines a wilderness-primitive area and provides direction on objectives; control of uses; maintenance of records; establishment, modification, or elimination of a wilderness area; commercial enterprises, roads, motor vehicles, etc.; grazing of livestock; permanent structures and commercial services; and other topics.

36 CFR 261.18: states the following are prohibited in national forest wilderness: (a) possessing or using a motor vehicle, motorboat, or motorized equipment except as authorized by Federal law or regulation; (b) possessing or using a hang glider or bicycle; (c) landing of aircraft, or dropping or picking up of any material, supplies, or person by means of aircraft, including a helicopter.

The Lee Metcalf Wilderness Act (Public Law 98-140) (October 31, 1983): established both the Lee Metcalf Wilderness and the Cabin Creek Recreation and Wildlife Management Area by public law 98-140. Cabin Creek Area "shall be managed to protect the wildlife and recreational values of these lands…"

Absaroka-Beartooth Wilderness Act of 1978 Public Law 95-249): designated the Absaroka-Beartooth Wilderness Area.

The Montana Wilderness Study Act of 1977 (Public Law 95-150): created eight wilderness study areas in Montana, including the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area, for review by the agency for their suitability for preservation as wilderness. The Montana Wilderness Study Act of 1977 specified that, "subject to existing private rights, the wilderness study areas designated by this act shall, until Congress determines otherwise, be administered by the secretary of agriculture so as to maintain their presently existing wilderness character and potential for inclusion in the National Wilderness Preservation System."

FSM 2320 (R 1 Supplement): provides direction for the management of wilderness study areas.

Forest Service Handbook (FSH) 1909.12 Chapter 70 Wilderness Recommendation: contains the framework for the wilderness recommendation process.

2001 Roadless Area Conservation Rule (36 CFR 294 Subpart B): establishes prohibitions on road construction and road reconstruction, and limitations on timber cutting, sale or removal within inventory roadless areas on National Forest System lands. The intent of the 2001 Roadless Rule is to provide lasting protection for inventory roadless areas within the national forest in the context of multiple-use management.

36 CFR Part 219 sec. 219.10(b)(1)(v): requires plan components (during revision) to provide protection of designated wild and scenic rivers as well as management of rivers found eligible or determined suitable for the national wild and scenic river system to protect the values that provide the basis for their suitability for inclusion in the system.

Forest Service Manual 4063: directs management of research natural areas as part of a national network of ecological areas allocated in perpetuity for research and education and/or to maintain biological diversity on National Forest System lands. Research natural areas are co-managed by the appropriate national forest and United States Forest Service research station.

Forest Service Manual 4063.03: Forest plans shall include analysis of, and recommendations for, the establishment of any proposed Research Natural Areas.

Establishment Records, Decision Notices, and Designation Orders for the following Research Natural Areas: Poker Jim (McGuire, 1974); Line Creek Plateau (Bosworth and Laverty. 2000); Lost Water Canyon (Fishburn 1994 ER; Jolley 1994 DN and DO; and McCallister, 2004 Errata); Decision Notice and Designation Order for the Black Butte, East Fork Mill Creek, Obsidian Sands, Palace Butte, Passage Creek, Sliding Mountain, and Wheeler Ridge Research Natural Areas (McCallister, K. 1997). These records provide information on the natural features, plant communities, and species present in each research natural area, as well as management decisions and guidance.

36 CFR 219.19: special areas are administratively designated areas, which are defined as an area identified and managed to maintain its unique special character or purpose.

Forest Service Manual 2370 and applicable National Environmental Policy Act decisions and designation orders: provide management guidance for these areas.

Decision Notices, and Designation Orders for the Special Areas: Decision Notice and Designation Order for the Black Sand Springs Special Area (McCallister, K. 1997) and Decision Notice and Finding of No Significant Impact and Designation Order for the establishment of the Bangtail Botanical and Paleontological Special Area (Tidwell, 2007). These records provide information on the natural features, plant communities, and species present in each special area, as well as management decisions and guidance.

Multiple Use-Sustained Yield Act of June 12, 1960 (P.L. 86-517, 74 Stat. 215, 16 U.S.C. 528-531): established the policy and purpose of the national forests to provide for multiple-use and sustained yield of products and services.

Wild Free-Roaming Horses and Burros Act of December 15, 1971 (P.L. 92-195, 85 Stat. 649, as amended; 16 U.S.C. 1331-1340): directs Federal management of wild horses and burros on Bureau of Land Management (BLM) and National Forest System lands. The act declares wild horses and burros to be “living symbols of the historic and pioneer spirit of the West.” Under the law, the BLM and Forest Service manage herds in their respective jurisdictions within areas where wild horses and burros were found roaming in 1971 at the time of the passage of the act.

36 CFR 222: provides regulations to protect, manage, and control wild free-roaming horses on National Forest System lands. Directs that if wild horses also use lands administered by the Bureau of Land Management as a part of their habitat, the Forest Service is to cooperate to the fullest extent with the Bureau of Land Management in administering the animals.

National Forest Management Act of October 22, 1976 (P.L. 94-588, 90 Stat. 2949, as amended; 16 U.S.C. 472a, 476, 500, 513-516, 518, 521b, 528 (note), 576b, 594-2 (note), 1600 (note), 1601 (note), 1600-1602, 1604, 1606, 1608-1614): reorganized, expanded, and otherwise amended the Forest and

Rangeland Renewable Resources Planning Act of 1974, which called for the management of renewable resources on National Forest System lands. The National Forest Management Act requires the secretary of agriculture to assess forest lands, develop a management program based on multiple-use, sustained-yield principles, and implement a resource management plan for each unit of the national forest. It is the primary statute governing the administration of national forests.

Public Rangelands Improvement Act of October 25, 1978 (92 Stat. 1803, 43 U.S.C. 1752-1753, 1901-1908): establishes a national policy and commitment to improve the conditions on public rangelands; requires a national inventory and consistent Federal management policies, and provides funds for range improvement projects. It also amends the Wild Free-Roaming Horses and Burros Act.

Forest Service Manual 2260: provides policy guidance for this area.

Pryor Mountain Wild Horse Range/Territory Environmental Assessment and Herd Management Plan (Bureau of Land Management, Forest Service, National Park Service, 2009) and Decision Notice (Forest Service, 2009): provides management guidance for this area.

The Madison River Canyon Earthquake Area (aka Earthquake Lake Geologic Area): is a 37,800-acre geological area, designated under the authority of the secretary of agriculture as a special geological area in 1960. The area was intended to allow the natural processes in this area to continue while providing for its use in conjunction with the safety and enjoyment of visitors.

National Trails System Act (Public Law 90-543): signed into law by President Lyndon B. Johnson on October 2, 1968. The purpose of the act was "to promote the preservation of, public access to, travel within, and enjoyment and appreciation of the open-air, outdoor areas and historic resources of the nation." This act authorized three types of trails: 1) national scenic trails, 2) national recreation trails, and 3) connecting-and-side trails. In 1978, national historic trails were also added to the national trail system. National scenic trails and national historic trails may only be designated by Congress. National recreation trails may be designated by the secretary of interior or the secretary of agriculture. Through designation, these trails are recognized as part of the American National Trail System.

FSM 2380.13 (1) Scenic Trails and Byways: authorizes the secretary of agriculture to administer and manage national scenic trails “for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas through which such trails may pass.”

Executive Order 13195, Trails for America (2001): addressed development and management of national scenic and historic trails by protecting trail corridors.

T S.2660 - 95th Congress (1977-1978) Continental Divide National Scenic Trail Act: A law that amends the National Trails System Act to establish the Continental Divide National Scenic Trail within Federal lands located in Montana, Idaho, Wyoming, Colorado, and New Mexico. Directs the secretary of agriculture to consult with relevant state and Federal officials in the administration of the lands designated under this act.

Trails for America in the 21st Century (Executive Order 13195): Signed by President Clinton in 2001 to achieve the common goal of better establishing and operating the American national system of trails.

The Continental Divide National Scenic Trail Comprehensive Plan (2009): as amended and conforming directives (FSM 2353.01d and FSM 2353.4)

The Nez Perce (Nimíipuu or Nee-Me-Poo) National Historic Trail Public Law No (99-44510/06/1986): added to the national trails system by Congress as a national historic trail.

Beartooth National Forest Scenic Highway February 8, 1989: the Chief of the Forest Service, United States Department of Agriculture, designates a route traversing National Forest System lands as national forest scenic byways.

Beartooth Highway All American Road (June 13, 2002): Federal Highway Administration, designated by the Department of Transportation, the most scenic byways are designated All-American Roads, which must meet two out of the six intrinsic qualities. The designation means they have features that do not exist elsewhere in the United States and are unique and important enough to be tourist destinations unto themselves.

The Beartooth Highway Comprehensive Road Corridor Management Plan (January 16, 2002): The Beartooth Highway is governed by a comprehensive road corridor management plan that includes the 53-mile Beartooth All-American Road, the Beartooth Highway National Forest Scenic Byway, and undesignated portions of the route.

Key Indicators and Measures

The differences between alternatives will be evaluated by:

- Considering effects of forest plan direction and how well it supports and protects the values associated with designated areas.
- The amount of overlap of other allocations, as applicable, and whether the overlapping allocations are compatible with the subject designation.

Methodology and Analysis Process

The analysis included a review of rules and regulations for the designated areas and an evaluation of the compatibility of the alternatives on designated areas.

It is assumed that designated areas are retained and the Custer Gallatin will be managed according to enabling laws, regulations, and policy, as well as by forest plan components. The analysis assumes that there will be no changes to inventoried roadless area boundaries or direction for the life of the plan. Under all alternatives, it is assumed that when designations and land allocations overlap, management activities would follow the management direction for each land allocation, with the most restrictive direction applying when direction conflicts.

Information Sources

Data sources included geographic information systems for mapping, the latest information from the National Visitor Use Monitoring project, information stored in the corporate database, research natural area guidance, a number of studies conducted on the Pryor Mountain Wild Horse Territory, and site-specific knowledge from forest personnel.

Analysis Area

Except for the Pryor Mountain Wild Horse Territory, the geographic scope of the analysis is the lands administered by the Custer Gallatin. The geographic scope of the analysis for the Pryor Mountain Wild Horse Territory is the lands administered by the Custer Gallatin in the Pryor Mountains. The scope for cumulative effects is described in the cumulative effects section of each designated area and the temporal scope is the anticipated life of the plan.

3.21.2 Designated Wilderness

Affected Environment (Existing Condition)

Wilderness areas provide a wide variety of user opportunities for exploration, solitude, natural environment, risk, challenge, and primitive and unconfined recreation; it represents the highest concentration of quiet places on the Custer Gallatin (where the sights and sounds of human presence are relatively unnoticeable). Many visitors use outfitter and guide services (operating under Forest Service special-use permits) in wilderness areas to part take in hiking, horseback riding, hunting, fishing, floating, and rafting.

Nationally, the Forest Service oversees 193 million acres of national forest and grasslands, of which 37 million acres (approximately 19 percent) are wilderness.

The Custer Gallatin National Forest manages significant portions of the Absaroka Beartooth and Lee Metcalf Wilderness Areas. Designated wilderness accounts for approximately 1,061,343 acres (nearly 35 percent) of the Custer Gallatin.

The National Visitor Use Monitoring program is used across the entire National Forest System (NFS); every 5 years each forest monitors their use through exit surveys. The monitoring data displayed below is for designated wilderness on the Custer Gallatin (it cannot be disaggregated by individual wilderness area or subunit). The Custer National Forest was surveyed in 2008 and 2013, the Gallatin National Forest was surveyed in 2009 and 2014.

Table 148 shows the number and percentage of visits to the wilderness areas within the Custer Gallatin. More than half of all visits to the designated wilderness in the Custer Gallatin were men (about 58 percent). People aging from 20 to 29 make up the largest group of visitors to the Custer Gallatin wilderness (roughly 30 percent) with an additional 45 percent of wilderness visitors distributed aging from 30 to 59.

Table 148. Forest and wilderness visits

Year	Total National Forest Visits	Visits within Designated Wilderness	Visits in Designated Wilderness (percent)
2013, 2014	3,100,000	440,000	15%
2008, 2009	1,900,000	201,000	11%

Absaroka Beartooth Wilderness

Congress designated the Absaroka Beartooth (AB) as a Wilderness Area in 1978 (PL 95-249), encompassing 943,626 acres. The Montana portion contains 920,343 acres on the Custer Gallatin National and the Wyoming portion contains 23,283 acres located on the Shoshone National Forest.

The Absaroka Beartooth consists of active glaciers, sweeping tundra plateaus (one of the largest expanses of tundra habitat over 10,000 feet in elevation in the lower 48 states), deep canyons, sparkling streams, and hundreds of alpine lakes; making it one of the most outstanding wilderness areas in America. Granite Peak (the tallest peak in Montana) towers at 12,799 feet in the middle of the Absaroka Beartooth Wilderness.

The Absaroka Mountains are characterize by vegetative cover, including dense forests and broad mountain meadows, and meandering streams. The mountain wildlife includes bighorn sheep, mountain goats, elk, deer, moose, marmots, coyotes, black bears, wolves and a substantial grizzly bear population. The harsher Beartooth Mountains are characterized by rocks and ice and have a less diverse wildlife population.

With over 700 miles of trails, the Absaroka Beartooth Wilderness is a hiking, backpacking, and equestrian heaven. Hiking and backpacking are more popular in the Beartooth Mountains, while traditional stock supported pack trips and hunting adventures are more common in the Absaroka Mountains. The nearly one million acres of wilderness provide many opportunities for primitive unconfined recreation and solitude, though many portions of the area are untrailed and rarely traveled.

Eight allotments (three active and five vacant) which make up about 2,650 acres of primary rangeland within the Absaroka Beartooth Wilderness. Section (4)(d)(4)(2) of the Wilderness Act allows livestock grazing where established prior to the designation of wilderness.

Lee Metcalf Wilderness

Congress passed the Lee Metcalf (LM) Wilderness bill in 1983, designating a total of 254,288 acres, all in the state of Montana; divided among the Custer Gallatin and Beaverhead-Deerlodge National Forests, as well as the Bureau of Land Management (BLM) lands.

This wilderness consists of four separate units in the Madison Mountain Range. There are approximately 140 miles of trail within the wilderness units with additional trails linking four units together. Large populations of deer, elk, moose, mountain lions, mountain goats, black bears, wolves, and grizzly bears live in these units. Additionally, the lakes and streams are home to cutthroats, graylings, rainbows, and brook trout. Popular recreation activities in the units consist of day hiking, backpacking, horseback riding, hunting, and fishing.

Landscapes vary from a huddle of high peaks rising above 10,000 feet and subalpine meadows, to the arid river corridor in Bear Trap Canyon managed by the Bureau of Land Management (BLM). As the BLM's first wilderness designation, it manages all of the Bear Trap Canyon Unit (approximately 6,000 acres); a stretch of wild canyon country along the Madison River.

The Monument Mountain Unit (lying on the northwest boundary of Yellowstone National Park) make up 32,408 acres of Custer Gallatin lands. This isolated area contains a diverse abundance of wildlife, including grizzly bears, and is lightly visited by humans.

The Spanish Peaks Unit encompass 68,060 acres of Custer Gallatin lands with steeply rugged, glaciated peaks rising more than 11,000 feet above scenic cirques and gem-like lakes. This heavily used area hosts a well-developed trail system and many popular destinations which are favorited to local and regional visitors.

The Taylor-Hilgard Unit consists of 33,380 acres of the Custer Gallatin. This unit runs along the crest of the Madison Range and has several peaks that exceed 11,000 feet above the Hilgard Basin. It is characterized by high mountain meadows and lakes surrounded by snowcapped summits. This unit is jointly managed by the Custer Gallatin and Beaverhead-Deerlodge National Forests.

One active grazing allotment is within the Lee Metcalf Wilderness with approximately 1,310 acres of primary rangeland.

Environmental Consequences

Current Plans

Management Direction under the Current Plans

The Wilderness Act of 1964 (Public Law 88-577) set up a system of wilderness areas across the United States and defined wilderness as a place,

> in contrast with those areas where man and his own works dominate the landscape… where earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain… an area of undeveloped Federal lands retaining its primeval character and influences, without permanent improvements or human habitation, which is protected and managed to preserve its natural condition.

Direction for the management of designated wilderness can be found in the 1964 Wilderness Act, subsequent area specific legislation, Forest Service Handbook and Manual 2320, and in the Custer and Gallatin Forest Plans. The Wilderness Act of 1964governs human use of designated wilderness. Project-specific proposals within designated wilderness are also evaluated through forest plan direction and a minimum requirement analysis to evaluate how the proposal may affect wilderness values. Commercial uses of wilderness are controlled by special-use permits and the plans of operation that are required under the special-use permit.

The Gallatin National Forest had been delegated as the lead forest by the Northern Region, Regional Forester for both the Absaroka Beartooth and Lee Metcalf Wilderness. The Gallatin Forest Plan (USDA 1987) advised how managers should update direction for solitude and primitive or unconfined recreational opportunities in wilderness. The Custer Forest Plan incorporated similar language.

The Draft Wilderness Management Plans have not been finalized as a comprehensive management plan to date. Elements of wilderness management have been imbedded in other forest level planning efforts. The Gallatin Travel Plan addressed trail based recreation and opportunity, the Gallatin Fire Amendment incorporated language for the management of wildland fire in the wilderness and the Gallatin Forest-wide Weeds Environmental Impact Statement speaks to the management of weeds with the wilderness.

The process prescribed for updating the Wilderness Management Plans is the Limits of Acceptable Change System for wilderness planning. The Absaroka Beartooth and Lee Metcalf Wilderness managers began an agency-driven version of this planning process in the mid-1990s. Inventory and monitoring work has been ongoing since to validate the original Limits of Acceptable Change polygons, and to support a final version of the LAC zones and associated standards and guidelines.

Three opportunity classes were defined and mapped for the Absaroka Beartooth and Lee Metcalf as an inventory. The three zones are a subset of the "primitive" recreation opportunity spectrum classification applied to all designated wilderness on the Custer Gallatin.

Effects of the Current Plans

There is no change in the amount of designated wilderness under the current plans. A primitive experience and wilderness character would be maintained for both wilderness areas under the current plans and the direction for designated wilderness management detailed in laws, regulations, and agency policy.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

Plan components address management to maintain wilderness characters including natural quality, opportunities for solitude, unconfined recreational use, and undeveloped and untrammeled landscapes.

The plan components developed for designated wilderness are the same in all revised plan alternatives. These forest plan components provide overarching direction that also set the stage for site-specific regulations to implement management direction which at times includes closures. In addition, direction for the management of designated wilderness can be found in the 1964 Wilderness Act, subsequent area specific legislation, and in the Forest Service Handbook and Manual 2320.

In all revised plan alternatives, any future wilderness management plans would exist outside of the forest plan. This allows the Custer Gallatin to provide additional direction for each individual wilderness area (often using wilderness zoning). These wilderness management plans would still adhere to the plan components of the revised forest plan.

Effects Common to the Revised Plan Alternatives

There is no change in the amount of designated wilderness and the effects, as a result of the revised plan, are the same in all alternatives. Because direction for designated wilderness management is detailed in laws, regulations, agency policy, and specific management plans, management under the four revised plan alternatives would not differ. Revised plan components should increase the Custer Gallatin's ability to respond to changes or threats to wilderness character.

A primitive experience would be maintained for both wilderness areas under all alternatives. Natural ecological processes and disturbances are the primary forces affecting the composition, structure, and patterns of vegetation. All alternatives would continue to manage and to protect and maintain their wilderness character.

Consequences to Designated Wilderness from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Fire and Fuels Management

The current plans' fire suppression direction from the Custer Forest Plan is to contain, control, and confine wilderness fires; while the Gallatin Forest Plan is similar to the revised plan alternatives by permitting fire to play its natural ecological role on the landscape. Revised plan direction for natural, unplanned ignitions would continue the long-term ecological processes in these areas. These could lead to a temporary loss of vegetation, reduction in water quality due to sedimentation, or air pollution;

however, these effects are part of the natural ecological processes. Some wildfires may be actively suppressed, based on factors evaluated at the time. Nevertheless, when natural fires are suppressed in fire adapted ecosystems, there could be detrimental effects to ecosystem processes, wildlife habitat, and biodiversity (Keane et al. 2002). Fire and fuels plan components call for minimum impact suppression tactics in designated wilderness. Exceptions may occur when a more direct attack is needed to protect life or adjacent property or mitigate risks to responders.

Effects from Watershed, Riparian, and Aquatic Management

The revised plan alternatives provide more detailed guidance than the current plans for protection of watersheds, riparian areas, and aquatic habitats. The revised plan alternatives include the adoption of riparian management zones (which are greater in size from the riparian zones currently identified) for streams east of the Continental Divide. Revised plan alternative plan components and objectives for aquatic ecosystems would promote the ecological integrity of watersheds, riparian areas, and aquatic habitats.

Effects from Wildlife Management

The revised plan alternatives have explicit wildlife plan components which address education of visitors on how to travel and camp in grizzly bear territory which are not included in the current plans. The revised plan alternatives promote visitor use of wilderness to co-exist with bears.

Effects of Land Allocations

Designated wilderness may contain other allocations, such as designated or eligible wild and scenic river corridors or research natural areas. Where land allocations overlap, the more protective direction applies; therefore, wilderness management components and regulations would prevail.

Effects from Access and Recreation Management

Wilderness may be affected by recreational use. Visitors to the wilderness may affect others' solitude, and camping may negatively affect vegetation and water quality through site compaction and improper disposal of human waste. In all alternatives, plan components are provided to protect the wilderness character from these potential effects. Plan components that limit areas of stock use, stock party size, hiking group size, and new designated campsites would help protect water quality and reduce potential noxious weed introductions. Revised plan alternatives prohibit motorized and mechanized recreation use within wilderness, except for the mobility impaired.

Effects from Scenery Management

In all alternatives, the scenery of designated wilderness is protected by plan components. In the current plans, the Gallatin Plan assigned a visual quality objective of preservation (equivalent to a very high scenic integrity objective) and the Custer Plan assigned a visual quality objective of retention (equivalent to a high scenic integrity objective). In the revised plan alternatives, the scenic integrity objective is very high for all designed wilderness and in this respect, the revised plan alternatives are more protective of scenery in designated wilderness than the current plans.

Effects from Permitted Livestock Grazing Management

While livestock grazing itself has the potential to degrade plant communities through invasive plant spread and damage to riparian areas. Revised plan alternative plan components emphasize the maintenance of resilient native plant communities as well as desirable riparian area conditions. The revised plan alternatives provide more detailed guidance than the current plans for resilient native plant communities and riparian areas that should help protect the ecological integrity of designated wilderness.

Cumulative Effects

Population growth and development increases the need for public open space. Growth in Yellowstone, Gallatin, and Park Counties is likely to increase recreational use of the Custer Gallatin, which may include an increase in wilderness use. Increased recreational use may impact the wilderness character, particularly the opportunities for solitude and natural quality. Examples of potential impacts include increased opportunity for crowding in high use areas, soil compaction or erosion, and threats to native plant species from the spread of noxious weeds from sources outside the wilderness. The effects of urbanization and population growth on wilderness use and resource conditions are likely to be gradual and to extend well beyond the planning period. These areas may be affected by management of adjacent lands, such as sights or sounds from vegetation treatments, motorized use, or private development.

There are currently about 110,005,000 acres of designated wilderness in the United States and are managed by four Federal agencies. Currently, the Custer Gallatin National Forest manages approximately 1 percent of the National Wilderness Preservation System and 30 percent of the 3,501,410 acres of designated wilderness within Montana, and manages none in South Dakota.

Conclusion

Since only Congress can establish wilderness areas, the acres and locations of designated wilderness would not vary in any of the alternatives, including the current plans. The revised plan alternatives plan components provide management direction for existing designated wilderness areas on the Custer Gallatin, including the protection and preservation of existing wilderness character and plan components for the management of facilities, trails, and outfitter and guide permits within designated wilderness. By providing the plan components outlined in the revised plan alternatives, the Custer Gallatin Revised Plan would meet the purpose and need of the forest plan, ensuring that designated wilderness areas are managed in ways that are ecologically and socially sustainable for present and future generations. Forest plan components and individual wilderness management plans would provide for the ongoing protection and preservation of the character in designated wilderness on the Custer Gallatin National Forest.

3.21.3 Wilderness Study Area

Affected Environment (Existing Condition)

The Custer Gallatin National Forest manages one congressionally designated wilderness study area, the approximately 155,000 (total inclusive acres) Hyalite-Porcupine-Buffalo Horn Wilderness Study Area. This area is located in the core of the Gallatin Range, stretching from Hyalite Canyon in the north to the Yellowstone National Park boundary in the south. This wilderness study area is approximately 36 miles long by 4 to 12 miles wide and contains 144,064 of lands managed by the Custer Gallatin and 11,513 acres in other ownership.

The Montana Wilderness Study Act of 1977 (Public Law 95-150) created eight wilderness study areas in Montana, including the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area, for review by the agency for their suitability for preservation as wilderness. The Montana Wilderness Study Act of 1977 specified that, “subject to existing private rights, the wilderness study areas designated by this Act shall, until Congress determines otherwise, be administered by the Secretary of Agriculture so as to maintain their presently existing wilderness character and potential for inclusion in the National Wilderness Preservation System.”

The Hyalite-Porcupine-Buffalo Horn Wilderness Study Area’s topography is highly variable. The northern portion of the study area contains jagged peaks, U-shaped valleys, and cirque basins. A more moderate topography is found in the remainder of the wilderness study area. Elevations range from approximately 5,500 feet to over 10,300 feet. The City of Bozeman is dependent on the Bozeman and Hyalite drainages for municipal water, and the headwaters of both are partially contained within the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area.

The wilderness study area supports diverse vegetation communities. At the lowest elevations grasslands are found, which then transition into Douglas-fir and limber pine stands. At higher elevations, lodgepole pine, spruce, and subalpine forests are found. The highest elevations contain whitebark pine and, beyond the timberline, alpine tundra or alpine turf. Forested portions of the wilderness study area are affected by mountain pine beetle epidemics, dwarf mistletoe, spruce budworm, and white pine blister rust.

The variety of habitats within this wilderness study area provide for a wide range of wildlife species. Important species found here include bighorn sheep, Rocky Mountain elk, grizzly bear, moose, wolverine, Arctic grayling, westslope cutthroat trout, Yellowstone cutthroat trout, and whitebark pine.

Unlike the wilderness inventory and evaluation process used during a plan revision, the wilderness study area boundaries drawn by Congress included miles of roads, private lands, timber harvest units and other facilities. In 1977, there were approximately 50,000 to 56,000 acres of private inholdings within the boundaries of the National Forest System lands included in the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area. These private lands were arranged in a checkerboard pattern across the wilderness study area. Since then, the Forest Service has acquired over 37,000 acres of this private land. The acquisition of these lands increased the number of public access points from 9 to 16 trailheads.

There have been a number of other changes in Hyalite-Porcupine-Buffalo Horn Wilderness Study Area use, rights, and facilities since 1977. Permitted livestock grazing has been reduced. Two range allotments have been waived back to the Forest Service and one has been rested since the Fridley Fire in 2001. Across active allotments, the number of permitted livestock has been reduced. Only two of three cabins present in 1977 remain. Snow survey sites have been reduced from four to two. No new trails have been constructed; only reconstruction or reroutes of failed existing trails have occurred and 1.5 miles of road were converted to trail via a restoration project. Six miles of road in the West Pine drainage were recontoured and reseeded. Many old logging roads have grown-in with trees and ground cover, although satellite imagery (in about 2003) showed 34 miles of remaining, visible old road within the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area.

The 1985 Hyalite-Porcupine-Buffalo Horn Wilderness Study Report indicated that visitor uses primarily included hiking, camping, hunting, snowmobiling, motorcycle riding, horseback riding, collecting specimens from the Gallatin Petrified Forest, and cross-country skiing (USDA Forest Service 1985). Big game hunting, trout and grayling fishing, and activities provided by outfitters, guides, and dude ranches were also popular. By 2003, Hyalite-Porcupine-Buffalo Horn Wilderness Study Area recreation uses had shifted. Combined with population increases in Gallatin and Park Counties, this shift resulted in notable increases in mountain biking, motorcycle and all-terrain vehicle use, snowmobiling, and ice climbing (Schlenker 2003, Clark et al. 2012).

Environmental Consequences

All Alternatives

Management Direction under All Alternatives

The wilderness study area on the Custer Gallatin National Forest is governed by the terms of the Montana Wilderness Study Act (Public Law 95-150) which is designed to protect and retain wilderness characteristics until Congress makes a final decision about this area. The Hyalite-Porcupine-Buffalo Horn Wilderness Study Area boundary can only be altered by Congressional action. Therefore, this boundary would remain under all alternatives. The entire wilderness study area is also inventoried roadless area, which this analysis assumes to remain in place for the life of the forest plan. Forest plan direction for both wilderness study area and inventoried roadless area allocations are in place for all alternatives.

Table 149 summarizes the land allocations, and uses allowed that would be in place under each of the alternatives, both with the wilderness study area in place, and if the wilderness study area were released by Congress. The total acreage shown (144,060) is for lands within the wilderness study area that are managed by the Custer Gallatin National Forest. Plan components for the various allocations would provide management direction for the acres shown in the table by alternatives.

Table 149. Hyalite-Porcupine-Buffalo Horn Wilderness Study Area (WSA) land allocations and management direction by alternative

Land Allocations/Management Direction	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Inventoried roadless area (acres)	144,064	144,064	144,064	144,064	144,064
Research natural area (acres)	1,280	1,280	1,280	1,280	1,280
Recommended wilderness (acres)	0	66,618	79,677	142,456	0
Backcountry area (acres)	0	21,539	38,103	0	144,064
Recreation emphasis area (acres)	0	12,606	21,031	0	0
No additional allocation other than inventoried roadless area (current management area acres in alternative A)	142,784	43,301	5,253	1,608	0
Motorized trail available (miles)	39.44	39.44	39.44	0	39.44
Trail closed to motorized use (miles)	0	0	0	39.44	0
Mechanized trail available (miles)	20.56	20.56	20.56	0	20.56
Trail closed to mechanized use (miles)	0	0	0	20.56	0
Under wilderness study area (WSA) direction, acres where new permanent roads allowed	0	0	0	0	0
If WSA released, acres where new permanent roads allowed	0	0	0	0	0

Land Allocations/Management Direction	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Under WSA direction, acres where new motorized trails allowed	0	0	0	0	0
If WSA released, acres suitable for motorized summer travel.	22,163	19,146	16,576	932	33,812
If WSA released, acres suitable for motorized winter over-snow vehicle travel.	9,208	8,540	8,123	55	19,491
Under WSA direction, acres where new mechanized trails allowed	0	0	0	0	0
If WSA released, acres suitable for new mechanized trails.	142,784	76,616	63,107	0	142,784
Under WSA direction, acres suitable for timber production or harvest (other than limited hazard tree removal)	0	0	0	0	0
If WSA released, forested acres suitable for timber production	0	0	0	0	0
If WSA released, forested acres unsuitable for timber production but where timber harvest may occur for other purposes; subject to Roadless Rule	101,134	57,236	20,018	777	101,134
Under WSA direction, acres where new developed recreation sites, energy and utility corridors, commercial communication sites, extraction of saleable minerals allowed	0	0	0	0	0
If WSA released, acres where new developed recreation sites, energy and utility corridors, commercial communication sites, extraction of saleable minerals, allowed, if roads not needed	142,784	55,077	25,004	1,608	0
Under WSA direction, acres where new recreation events allowed	0	0	0	0	0
If WSA released, acres where new recreation events allowed	142,784	54,627	25,004	1,608	142,784
Under WSA direction, acres where new recreational aircraft landing strips allowed.	0	0	0	0	0
If WSA released, acres of ROS settings where new recreational aircraft landing strips would be suitable.	17,946	17,946	15,376	0	32,511

Alternative A represents the current plans' future projections if kept

Table 150. Summer recreation opportunity spectrum within the wilderness study area by alternative

Recreation Opportunity Spectrum Class	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Rural	639	636	501	36	639
Roaded Natural	966	309	159	887	966
Semi-Primitive Motorized	20,558	18,201	15,916	9	32,207
Semi-Primitive Nonmotorized	121,902	124,919	47,496	665	110,253
Primitive	0	0	79,992	142,468	0

Alternative A represents the current plans' future projections if kept

Table 151. Winter recreation opportunity spectrum within the wilderness study area by alternative

Recreation Opportunity Spectrum Class	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Rural	389	389	251	30	389
Roaded Natural	139	139	139	7	139
Semi-Primitive Motorized	8,680	8,012	7,732	18	18,963
Semi-Primitive Nonmotorized	134,856	135,524	55,998	1,552	124,573
Primitive	0	0	79,943	142,457	0

Alternative A represents the current plans' future projections if kept

Current Plans

Management Direction under the Current Plans

Unlike designated wilderness, wilderness study areas may still permit some activities and uses that are precluded from designated wilderness (as long as these activities do not degrade wilderness character as it is known to have existed in 1977, per the Montana Wilderness Study Act of 1977).

In the early 1980s, the Forest Service studied the suitability of the area for inclusion in the wilderness preservation system, and recommended that it not be designated wilderness at that time. The checkerboard ownership pattern was largely responsible for the conclusion that the area was unsuitable for wilderness designation. Since then, nearly 37,000 acres of private land have been acquired as national forest within the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area boundary.

National forest-level management direction for the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area in the Gallatin Forest Plan and the travel management plan reiterate the need to manage the area consistent with the Montana Wilderness Study Act of 1977. The act specified, “subject to existing private rights, the wilderness study areas designated by this Act shall, until Congress determines otherwise, be administered by the Secretary of Agriculture so as to maintain their presently existing wilderness character and potential for inclusion in the National Wilderness Preservation System” (Public Law 95-150). National forest-level management direction for the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area can be found in the 1987 Gallatin Forest Plan, Gallatin-wide standards, the Gallatin travel management plan, and two management areas, which reiterate the need to manage the area consistent with the Montana Wilderness Study Act.

In 2006, the Gallatin National Forest published its Record of Decision for the Final Travel Management Plan. The decision established summer and winter travel management direction across the entire Gallatin National Forest, including the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area. This decision received 113 appeals in 2007 and was subsequently upheld by the Regional Forester. In response, Citizens for Balanced Use filed suit on the travel management plan in its entirety, and the Montana Wilderness Association, Greater Yellowstone Coalition, and The Wilderness Society challenged the wilderness study area’s management direction. All complaints were joined and addressed in District Court. The court ruled on these complaints in September 2009, upholding the Travel Management Plan Decision in all areas other than the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area. Within the wilderness study area, the travel decision was enjoined, and in its place the Gallatin National Forest implemented interim summer and winter travel orders further restricting mechanized and motorized travel therein. This winter interim order was promptly challenged in District Court by Citizens for

Balanced Use. Shortly after the 2009 District Court ruling, the Forest Service and Citizens for Balanced Use appealed the District Court Decision to the 9th Circuit Court.

In December 2011, the 9th Circuit Court ruled that the 2006 Travel Plan Decision within the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area did not adequately protect wilderness character. On June 25, 2012, District Court Judge Haddon found that the Citizens for Balanced Use subsequent suit had been “squarely resolved” by the 9th decision in the case of Russell Country Sportsmen v. United States Forest Service and granted the defendants motion for summary judgment.

Effects of the Current Plans

Current Gallatin forest plan direction would continue for the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area; it would continue to be managed consistent with the Montana Wilderness Study Act of 1977 and the 2001 Roadless Area Conservation Rule (Roadless Rule). The following tables list mechanized (bicycle) and motorized trails within the wilderness study area under the current Gallatin forest plan.

Table 152. Bicycle trails within the wilderness study area under the current plan

Trail Name	Miles
Blackmore	3.58
Donahue	3.62
First Creek Cutoff	0.97
History Rock	1.46
North Dry Divide	1.47
South Cottonwood	4.43
Storm Castle Ridge	2.82
Twin Cabin	0.38
West Pine	1.82
Bicycle Trails Total	20.56

Table 153. Motorcycle trails within the wilderness study area under the current plan

Trail Name	Miles
Buffalo Horn	3.24
East Fork Hyalite	4.70
Hidden Lake Cutoff	0.75
Hidden Lake Divide	4.56
Hyalite Creek	4.64
Porcupine Creek	3.84
Porcupine Meadows	7.17
Ramshorn Lake	5.65
Storm Castle Creek	4.89
Motorcycle Trails Total	39.44

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

The revised plan alternatives include plan components that would provide direction for the management of the wilderness study area including the protection and preservation of existing wilderness characteristics and guidelines for the management of facilities, utilities, trails, and outfitter and guide permits within the wilderness study area.

If the wilderness study area were released by Congress, the entire area would continue to be managed as an inventoried roadless area with restrictions on roads and timber harvest. Inventoried roadless area allocation alone does not rule out mechanized and motorized trail use.

If the wilderness study area were released by Congress, the forest plan provides an array of potential management options. In all alternatives, the wilderness study area is subject to the requirement of the 2001 Roadless Area Conservation Rule.

In alternative E, the Buffalo Horn backcountry area would be suitable for mechanized recreation use and motorized recreation use on existing motorized routes, and for new motorized and mechanized recreation use in semi-primitive motorized recreation corridors.

Alternative B

Effects of Alternative B

The wilderness study area would continue to be managed consistent with the Montana Wilderness Study Act of 1977 and the 2001 Roadless Area Conservation Rule. Under alternative B, if the wilderness study area were released by Congress, 66,618 acres would become a recommended wilderness area, 21,539 acres would become a backcountry area, and 12,606 acres would become a recreation emphasis area. These areas would have management direction for those allocations in addition to direction for inventoried roadless areas. Another 43,301 acres would have no additional direction beyond inventoried roadless area direction. See the narratives for each of those allocations for explanation of effects under direction for alternative B.

Within this alternative, the boundaries for recommended wilderness do not include any of the portions of current trails used for mechanized or motorized use as shown in table 152 and table 153, so they do not change current recreation suitability. Backcountry area and recreation emphasis area allocations also continue current recreation suitability in alternative B.

Alternative C

Effects of Alternative C

The Hyalite-Porcupine-Buffalo Horn Wilderness Study Area would continue to be managed consistent with the Montana Wilderness Study Act of 1977 and the 2001 Roadless Area Conservation Rule. Under alternative C, if the wilderness study area were released by Congress, 79,677 acres would become a recommended wilderness area, 38,103 acres would become a backcountry area, and 21,031 acres would become a recreation emphasis area. These areas would have management direction for those allocations, in addition to inventoried roadless area direction. All but about 5,200 acres of the area within the boundary of the wilderness study area would be covered with a recommended wilderness area, backcountry area, or recreation emphasis area allocation. See discussion for each of those allocations for effects of management.

Within this alternative, the boundaries for recommended wilderness do not include any of the portions of current trails used for mechanized or motorized transport use as shown in table 152 and table 153, so they do not change current recreation suitability. Backcountry area and recreation emphasis area allocations also continue current recreation suitability in alternative C.

Alternative D

Effects of Alternative D

The Hyalite-Porcupine-Buffalo Horn Wilderness Study Area would continue to be managed consistent with the Montana Wilderness Study Act of 1977 and the 2001 Roadless Area Conservation Rule. If the wilderness study area were released by Congress, the entire wilderness study area would continue to be managed as an inventoried roadless area. In alternative D, all but about 1,600 acres of the wilderness study area would become a recommended wilderness area. As listed in table 154 and table 155, under alternative D existing motorized and mechanized transport would no longer be suitable on the following trails.

Table 154. Trails no longer available for bicycle use in alternative D

Trail Name	Total Miles
Blackmore	3.55
Donahue	2.96
First Creek Cutoff	0.53
History Rock	1.46
North Dry Divide	1.47
South Cottonwood	4.43
Storm Castle Ridge	2.82
Twin Cabin	0.38
West Pine	1.82
Bicycle Trails Total	19.42

Table 155. Trails no longer available for motorcycle use in alternative D

Trail Name	Total Miles
Buffalo Horn	1.52
East Fork Hyalite	4.70
Hidden Lake Cutoff	0.75
Hidden Lake Divide	4.56
Hyalite Creek	4.63
Porcupine Creek	3.84
Porcupine Meadows	7.17
Ramshorn Lake	3.71
Storm Castle Creek	4.89
Motorcycle Trails Total	35.77

Alternative E

Effects of Alternative E

The wilderness study area would continue to be managed consistent with the Montana Wilderness Study Act of 1977 and the 2001 Roadless Area Conservation Rule. In alternative E, the entire wilderness study area would become the Buffalo Horn Backcountry Area. There would be an increase in mechanized and motorized recreation opportunities because a larger amount of the area would be suitable for those uses in semi-primitive motorized recreation corridors. Under this alternative, the current uses by motorized and mechanized equipment on trails listed in table 152 and table 153 would continue.

Consequences to Wilderness Study Area from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Wildlife Management

Plan components that provide for restoration of wildlife habitat would enhance the wilderness characteristics of the wilderness study area.

Effects from Fire and Fuels Management

Current fire plan direction is similar to the revised plan alternatives by permitting fire to play its natural ecological role on the landscape. Revised plan alternatives fire and fuels plan direction would encourage an appropriate management response to wildfires that may occur within wilderness study areas, and provide opportunities for natural fire to promote or enhance the wilderness characteristics of these areas. Fire and fuels management plan components also specify the use of minimum impact strategies and tactics to manage wildland fire within wilderness study areas, which would further protect wilderness characteristics. Some wildfires may be actively suppressed, based on factors evaluated at the time. However, when natural fires are suppressed in fire adapted ecosystems, there could be detrimental effects to ecosystem processes, wildlife habitat and biodiversity (Keane et al. 2002).

Effects from Vegetation Management

Plan direction states the wilderness study area is not suitable for timber production in any alternative. Vegetation management activities such as weed treatment could be allowed, subject to the requirements of the 2001 Roadless Area Conservation Rule.

Effects from Energy and Minerals Management

The Hyalite/Porcupine-Buffalo Horn Wilderness Study Area would be managed and regulated according to existing direction. According to plan components and minerals regulations, this area would continue to be not available for mineral leasing and salable mineral materials based on the provision in the law requiring this area to be managed to maintain its wilderness character. However, the area is still open to locatable mineral prospecting, exploration, and development.

Potential impacts would be reduced by the revised plan alternatives direction that mineral and energy resource development consider other resource values, and that land be returned to a productive capacity after mineral or energy activity.

Cumulative Effects

Population growth and development increases the need for public open space. Growth in areas surrounding the national forest is likely to increase recreational use of the Custer Gallatin National

Forest, including an increase in wilderness use. The effects of urbanization and population growth on wilderness use and resource conditions are likely to be gradual and extend well beyond the planning period.

Conclusion

Since the Hyalite-Porcupine-Buffalo Horn Wilderness Study Area is congressionally designated, the acres and boundaries of the wilderness study area would not vary in any of the alternatives, including the current plans. In all alternatives, the wilderness study area will continue to be managed consistent with the Montana Wilderness Study Act of 1977. The alternative’s revised plan components ensure that the wilderness study area is managed to retain the 1977 character until Congressional actions occurs. In all alternatives, the wilderness study area also must meet guidance of the Inventoried Roadless Conservation Area Rule and plan components for inventoried roadless areas.

The revised plan alternatives provide a variety of potential allocations should Congress release the wilderness study area. The options range from nearly all of the wilderness study area as recommend wilderness area (alternative D), to all of the wilderness study area as a backcountry area (alternative E), with alternatives B and C providing a mix of recommend wilderness area, backcountry area and recreation emphasis area.

3.21.4 Cabin Creek Recreation and Wildlife Management Area

Affected Environment (Existing Condition)

Located entirely on the Hebgen Lake Ranger District, the 36,752-acre Cabin Creek Recreation and Wildlife Management Area was designated by the Lee Metcalf Wilderness Act. On October 31, 1983, public law 98-140 established the Cabin Creek area for the purpose of protecting and enhancing wildlife (specifically grizzly bears and elk) while providing for existing recreational uses. The area encompasses Upper Wapiti Creek, Carrot Basin, and Cabin Creek drainages. The primary conservation area for grizzly bears encompasses the Cabin Creek Recreation and Wildlife Management Area. There is an extensive system of both motorized single-track trails and non-motorized trails. Three major trailheads open mid-summer and provide access for up to 30 miles of single track motorized recreation use. The Cabin Creek Cabin is a popular rental located near the southern boundary and provides the public with an opportunity to stay overnight in a historic facility. The fall season focuses on elk hunting where a large outfitter guide services are present and motorized retrieval of big game is allowed. During the winter season snowmobile use is active, with both marked routes, groomed trails, and many open areas and bowls provide riding areas. Two closed grazing allotments are within the Cabin Creek Recreation and Wildlife Management Area, but no permitted grazing is allowed.

Under the enabling legislation, this area “shall be hereby withdrawn from all forms of appropriation under the mining laws and from disposition under all laws pertaining to mineral leasing and geothermal leasing…”

Environmental Consequences

Current Plans

Management Direction under the Current Plans

Under the 1987 Gallatin Forest plan (Management Area 20), the staff is directed to manage the Cabin Creek Recreation and Wildlife Management Area consistent with the legislation, which are for the purposes of grizzly bears, big game, and recreation. Management restrictions of recreational activities are allowed to protect wildlife. Fish and wildlife habitat improvements, existing grazing, and prescribed fire are allowed if consistent with area goals, and chainsaws are permitted for trail maintenance. The 2006 Gallatin Travel Plan decision allows broad use of the Cabin Creek area by several different types of recreation users, such as retrieving animals killed during hunting season on motor bikes or snowmobiles.

The plan classified the area as unsuitable for timber production, therefore, no timber harvest will occur. However, vegetation or fire treatments to enhance wildlife habitat or wilderness character are allowed.

Effects of the Current Plans

In general, recreation use is expected to increase over the lifetime of the plan, including the Cabin Creek Recreation and Wildlife Management Area, as population growth in the surrounding area increases. The activities for both motorized and non-motorized trail use, elk hunting, snowmobiling, and the cabin rental program will likely continue to be popular. Per the current direction, recreation will continue to manage existing wilderness characters, protect wildlife, and to enhance the area to support grizzly bear and elk habitat. The removal of two grazing allotments will allow natural processes to restore the areas.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

Plan components for the Cabin Creek Recreation and Wildlife Management Area are the same for all revised plan alternatives and follow the requirements of the implementing legislation public law 98-140. Plan components limit uses such as new roads, utility corridors, and commercial communication sites. Additionally, the area is withdrawn from mining and oil and gas leasing.

Effects of the Revised Plan Alternatives

All revised plan alternatives would follow plan direction that established the Cabin Creek Recreation and Wildlife Management Area.

Consequences to Cabin Creek Recreation and Wildlife Management Area from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Vegetation and Timber Management

In all alternatives, plan direction and the enabling legislation state the Cabin Creek Recreation and Wildlife Area is not suitable for timber production. Restoration projects that benefit wilderness character, grizzly bears, and big game wildlife are allowed in all alternatives. Under the current plans, no timber harvest is allowed, while in the revised plan alternatives, timber harvest may be allowed for purposes such as fuels reduction, restoration, or wildlife habitat enhancement. Therefore, the revised plan alternatives provide more avenues for projects that benefit the natural character of the area. This, coupled with vegetation components for ecological diversity, resilience, and sustainability may enhance the resilience of the Cabin Creek Recreation and Wildlife Management Area.

Effects from Fire and Fuels Management

Under the current plans fire plan direction is similar to the revised plan alternatives by permitting fire to play its natural ecological role on the landscape. Revised plan alternative plan direction for natural, unplanned ignitions would continue the long-term ecological processes in these areas. Fires could lead to a temporary loss of vegetation, reduction in water quality due to sedimentation, or air pollution; however, these effects are part of the natural ecological processes. Some wildfires may be actively suppressed based on factors evaluated at the time. However, when natural fires are suppressed in fire adapted ecosystems, there could be detrimental effects to ecosystem processes, wildlife habitat, and biodiversity (Keane et al. 2002). Revised plan alternative fire and fuels plan components call for minimum impact suppression tactics in sensitive areas. Exceptions may occur when a more direct attack is needed to protect life, adjacent property, or to mitigate risks to responders.

Effects from Watershed, Riparian, and Aquatic Management

The revised plan alternatives provide more detailed guidance than the current plans for protection of watersheds, riparian areas, and aquatic habitats. The revised plan alternatives include the adoption of riparian management zones, which are greater in size from the riparian zones currently identified for streams east of the Continental Divide. Revised plan alternative plan components and objectives for aquatic ecosystems would complement the overall management of the Cabin Creek Recreation and Wildlife Management Area by promoting the ecological integrity of watersheds, riparian areas, and aquatic habitats.

Effects from Wildlife Management

In all alternatives, this area is entirely within the grizzly bear recovery zone and wildlife plan direction is based on the conservation strategy for the bears in the Greater Yellowstone ecosystem. Among other things, this direction is designed to maintain an adequate amount of secure habitat, which limits disturbances from motorized access. It also sets limits on the amount and capacity of developed sites, as well as the amount of area affected by permitted livestock grazing. The management direction for grizzly bear provides habitat protections for a variety of wildlife species sensitive to human disturbance and/or affected by livestock.

Effects of Land Allocation of Inventoried Roadless Area

In all alternatives, all 36,752 acres are deemed an inventoried roadless area, which constrains management actions especially for timber production and new road construction to conform to that 2001 Roadless Area Conservation Rule. Because it has been designated by Congress as a non-wilderness recreation and wildlife area, the no action alternative (current Gallatin plan) proposes the area as a recommended wilderness area.

Effects from Access and Recreation Management

In all alternatives, new road access is prohibited under enabling legislation, plan direction and the fact this is within an inventoried roadless area. Current motorized trail access is authorized as directed under the 2006 Gallatin Travel Plan.

Recreation management allows for current uses as long as they do not adversely impact grizzly bears and big game, or create other unacceptable levels of resource damage. Recreation opportunity spectrum classifications are the same in all alternatives. The revised plan alternatives explicitly limit new developed recreation facilities, new recreation events, and recreational and commercial drone launching and landings. The current plans do not explicitly limit these uses.

Effects from Land Uses Management

As this area is managed to maintain existing wilderness characteristics and protect wildlife habitat, revised plan alternative plan components state new utility or energy corridors and new commercial communication sites shall not be allowed. Potential facilities would be required to locate elsewhere which might result in increased costs or limits to optimum communication facility sightings. The current plans do not explicitly limit new utility or energy corridors or new commercial communication sites; however, those would be incompatible with wilderness characteristics.

Cumulative Effects

Management activities generally have taken place and will continue to take place mostly outside of the Cabin Creek Recreation and Wildlife Management Area. It is unlikely they would have an effect on the areas due to the distance of management activities from the areas and various plan components that protect soils, water, and other resource values forestwide.

Control of invasive weeds is an action that may have occurred in the past within the area and is the most likely management activity to occur in the future. This would likely have a positive effect on the area by controlling invasive weeds and preventing their spread. There may be other vegetation treatments for restoration purposes, such as non-commercial removal of small diameter woody fuels, which would be constrained by the Cabin Creek Recreation and Wildlife Management Area because it is also an inventoried roadless area. These fuel reduction actions may be desirable to reduce the severity of potential future fires, protecting the values associated both with and adjacent to the area. These restoration activities are not expected to result in detrimental effects to the values in the area.

Conclusions

In the current plans, Cabin Creek Recreation and Wildlife Management Area would continue to be managed as per guidance under Public law 98-140. Plan direction provided for the Cabin Creek Recreation and Wildlife Management Area in the 1987 Gallatin National Forest Plan would continue. Revised plan alternatives also provide plan components for the Cabin Creek Recreation and Wildlife Management Area that support the enabling legislation.

3.21.5 Designated Wild and Scenic Rivers

Affected Environment (Existing Condition)

Congress passed the National Wild and Scenic Rivers System Act in 1968 (Pub. L. 90-542; 16 U.S.C. 1271 et seq.) for the purpose of preserving rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. The act is recognized for safeguarding the special character of these rivers while also allowing for their appropriate use and development. The act promotes river management across political boundaries and public participation in developing goals for river protection.

For wild and scenic rivers, the designated management boundaries generally average 0.25 mile on each bank in the lower 48 states. The purpose of this 0.25-mile management corridor is to protect river-related values. For management purposes, river segments are classified as wild, scenic, or recreational.

- Wild River: Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.
- Scenic River: Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.
- Recreational River: Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

There is currently one congressionally designated Wild and Scenic River, East Rosebud Creek, on the Custer Gallatin National Forest. On August 2, 2018, the Act HR4645 was signed by the president designating East Rosebud Creek as part of the National Wild and Scenic River System:

> East Rosebud Creek, Montana.—The portions of East Rosebud Creek in the State of Montana, consisting of—‘‘(A) the 13-mile segment exclusively on public land within the Custer National Forest from the source in the Absaroka-Beartooth Wilderness downstream to the point at which the creek enters East Rosebud Lake, including the stream reach between Twin Outlets Lake and Fossil Lake, to be administered by the secretary of agriculture as a wild river; and (B) the 7-mile segment exclusively on public land within the Custer National Forest from immediately below, but not including, the outlet of East Rosebud Lake downstream to the point at which the Creek enters private property for the first time, to be administered by the secretary of agriculture as a recreational river.’’

This creek became the first designated wild and scenic river in the Montana since 1976 and is the only designated river on the Custer Gallatin National Forest. Located in Carbon County, Montana, the East Rosebud Creek flows through the Absaroka-Beartooth Wilderness into the Stillwater River and eventually into the Yellowstone River. There are approximately 20 total river miles and 6,400 total acres within the ½-mile corridor of the East Rosebud Wild and Scenic River management corridor. None of this designated stretch of river is within inventoried roadless areas.

The East Rosebud grazing allotment occurs within the corridor’s recreational segment, with approximately 935 acres. There is approximately ¼ mile of allotment fence within the corridor and no water developments. The East Rosebud allotment is permitted with cow/calf pair with variable numbers and dates between September 1 and November 1, not to exceed 150 animal unit months.

Environmental Consequences

Current Plans

Management Direction under the Current Plans

There are no plan components in the current 1986 Custer Forest plan for the designated East Rosebud Wild and Scenic River. Pending the completion of the revised forest plan and a river management plan, management guidance for the East Rosebud Creek designated Wild and Scenic River is provided through the enabling legislation and agency-wide policy and regulations. This management direction applies for the ½ mile corridor. The designation and management direction only apply to National Forest System lands.

The outstandingly remarkable values (ORVs) are scenic, recreational, and geologic. The river is classified as wild for 13 miles in the Absaroka-Beartooth Wilderness area and as recreational for 7 miles downstream of the wilderness. Regulatory direction is to protect or enhance the listed ORVs and the classification status of each segment, along with protecting the free-flowing nature of the creek.

Effects of the Current Plans

While there are no plan components in the current Custer Forest Plan, the regulatory direction to protect or enhance the listed outstandingly remarkable values and the classification status of each segment, along with protecting the free-flowing nature of the creek, would apply to the current plans.

Revised Plan Alternatives

Management direction under the Revised Plan Alternatives

The river designated as a Wild and Scenic River does not change by any revised plan alternative. Plan components in all revised plan alternatives protect the river's free-flowing nature, preliminary classification, and outstandingly remarkable value(s). Plan components provide direction for topics such as timber production, wildfire, and fish barrier construction in the designated Wild and Scenic River corridor. None of the designated corridor is within an inventoried roadless area.

Effects of all Revised Plan Alternatives

Under all revised plan alternatives, the identified designated Wild and Scenic River (and area within ¼ mile on either side of each river's high water mark) would be managed to protect its free-flowing condition and to preserve and enhance the outstandingly remarkable value(s) for which it was identified, as well as protect the segment's classification.

Some of the designated river corridor lands are also within designated wilderness, where the increases protection of a designated river is an addition to existing wilderness management. As protection or enhancement of listed outstandingly remarkable values for the river segment are called for along with retaining the preliminary classification listed, designated river corridors should remain in a similar or improved condition for the current and foreseeable future.

Consequences to Designated Wild and Scenic Rivers from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Timber Management

In all alternatives, designated wild classified rivers are not suitable for timber production. Timber harvest would be allowed when needed in association with a primitive recreation experience, to protect users, or to protect identified outstandingly remarkable values. Examples of such exceptions include activities to maintain trails or suppress wildfires. For designated scenic and recreational rivers there is a range of vegetation management and timber harvest practices which are allowed, if these practices are designed to protect users, or protect, restore, or enhance the river environment, including the scenic character in the long term.

Effects from Fire and Fuels Management

Both natural and management-ignited fires could change the outstandingly remarkable values present in a river segment such as scenery or historic resources.

The current plans' fire suppression directions are a range of responses. To minimize resource damage, the revised plan alternatives fire and fuels plan components call for minimum impact suppression tactics in sensitive areas such as eligible wild and scenic rivers, which would reduce resource impacts from the suppression effort itself. Exceptions may occur when a more direct attack is needed to protect life or adjacent property or mitigate risks to responders.

Natural, unplanned ignitions and prescribed fires are used as tools to maintain ecological conditions within river corridors. These fire and fuels management components may be used so long as they maintain the outstandingly remarkable values (ORVs) and free-flowing nature of the identified rivers. In a designated river segment, wildland fires managed to meet resource objectives may be used to restore or maintain ORVs. In the revised plan alternatives, plan components for fire and fuels management would encourage an appropriate management response to wildfires and provide opportunities for natural fire to promote and/or enhance the characteristics of these areas.

Effects from Watershed, Riparian, and Aquatic Management

The revised plan alternatives provide more detailed guidance than the current plans for protection of watersheds, riparian areas, and aquatic habitats. The revised plan alternatives include the adoption of riparian management zones, which are greater in size from the riparian zones currently identified for streams east of the Continental Divide. Plan components and activities related to watershed, riparian, or aquatic habitat improvements would have a protective effect to designated wild and scenic rivers, as they would to all rivers on the Custer Gallatin. The area influenced by riparian plan components (up to 200 feet, depending on water body) is a shorter distance than the ¼ mile area on either side of the high-water mark of the stream where wild and scenic components apply, but provide very detailed protection.

Effects from Wildlife and Fisheries Management

For all river classifications construction of minor structures and vegetation management to protect and enhance wildlife and fish habitat should harmonize with the wild segment's essentially primitive character, the scenic rivers largely undeveloped character, and the recreational segments identified river values. Any portion of a proposed wildlife or fisheries restoration or enhancement project that has the potential to affect the river's free-flowing character must be evaluated as a water resources project. For example, fish barriers would be evaluated as a water resource project to ensure free-flowing waters are not affected, but also that construction of the shoreline development does not affect the classification.

Effects of Land Allocations

For all alternatives, where a designated river segment is within another designation that has stricter components, those stricter management components take precedence. This may occur when a designated river segment is in wilderness, recommended wilderness, inventoried roadless areas, research natural areas, and special areas etc.

Effects from Energy and Minerals Management

In all alternatives, the portion of the East Rosebud designated wild and scenic river classified as "wild" is withdrawn from mineral entry. In the revised plan alternatives, the portion classified as "recreational" would not be available for saleable mineral material extraction; there are no plan components to restrict this use in the current plans. In all alternatives, leasable and locatable mineral development is allowable within the "recreational" segment. Potential impacts would be reduced by direction in all alternatives that mineral and energy resource development consider other resource values.

Cumulative Effects

Cumulative effects are the potential impacts to designated wild and scenic rivers from the alternatives when combined with past, present, and reasonably foreseeable actions.

The designation as a wild and scenic river means that no dams would be built on this river segments and it would remain free flowing. Management activities generally take place outside of designated wild and scenic rivers unless an action is needed to help protect or preserve the identified outstandingly remarkable value. For example, if invasive weeds were discovered in a designated river corridor, there might be a need to take some action (hand pulling, herbicide application) to eradicate or prevent further spread. An ongoing grazing allotment in the recreational segment of the river would be managed to maintain it as a compatible use without impacts to outstandingly remarkable values or classification or the free-flowing status.

There may be an increase in recreational use of the designated river, as the publicity of designation itself may call attention to the river as a destination.

Less than 1 percent of Montana's river miles are protected under the Federal act. The sections of four rivers currently protected are a 149-mile stretch of the Upper Missouri River, and 219 miles of the North, Middle, and South Forks of the Flathead River, and East Rosebud Creek. Nationally, less than 0.25 percent or 12,734 miles of the country's river miles are protected under the wild and scenic designation.

Conclusion

The addition of this designated river and 6,400 acres within the ½-mile river buffers means that the Custer Gallatin for the first time will manage those acres for the values of a designated wild and scenic river. There are management requirements within the legislation as well as agency policy and regulations. New plan components for rivers managed as designated for the national wild and scenic river system would protect or enhance the outstandingly remarkable values, keep the rivers free flowing, and maintain the assigned classifications for each river segment.

3.21.6 Inventoried Roadless Areas

Affected Environment (Existing Condition)

Inventoried roadless areas are designated under the 2001 Roadless Area Conservation Rule 36 CFR 294.13. There are approximately 848,091 acres of lands established as official inventoried roadless areas across the national forest. These roadless areas constitute approximately 28 percent of the lands administered by the Custer Gallatin National Forest.

The following values or features often characterize inventoried roadless areas:

- High quality or undisturbed soil, water, and air. These three key resources are the foundation upon which other resource values and outputs depend.
- Sources of public drinking water. National Forest System lands contain watersheds that are important sources of public drinking water.

- Diversity of plant and animal communities. Roadless areas are more likely than roaded areas to support greater ecosystem health, including the diversity of native and desired nonnative plant and animal communities due to the absence of disturbances caused by roads and accompanying activities.
- Habitat for threatened, endangered, proposed, candidate, and for those species dependent on large, undisturbed areas of land. Roadless areas function as biological strongholds and refuges for many species.
- Primitive, semi-primitive nonmotorized, and semi-primitive motorized recreational opportunity spectrum classes of dispersed recreation. Roadless areas often provide outstanding dispersed recreation opportunities such as hiking, camping, picnicking, wildlife viewing, hunting, fishing, cross-country skiing, and canoeing. While they may have many wilderness-like attributes, unlike wilderness, the use of mountain bikes, and other mechanized and motorized trails usage is often allowed. These areas can also take pressure off heavily used wilderness areas by providing solitude and quiet, and dispersed recreation opportunities.
- Natural appearing landscapes with high scenic quality. High quality scenery, especially scenery with natural-appearing landscapes, is a primary reason that people choose to recreate.
- Traditional cultural properties and sacred sites. Traditional cultural properties are places, sites, structures, art, or objects that have played an important role in the cultural history of a group.
- Other locally identified unique characteristics. Inventoried roadless areas may offer other locally identified unique characteristics and values.

While roads exist in some inventoried roadless areas, the overall setting of these areas is generally roadless. Compared to other National Forest System lands, roads in inventory roadless areas are rare. During the 2001 roadless area evaluation process some areas were included as roadless even though a road, or portion of a road, was present. In most cases, the road was determined to not substantially detract from the areas roadless characteristic or potential. However, in some instances, practical management boundaries or geographic features favored including small sections of roads in inventory roadless areas rather than drawing the boundary to exclude the road section. There were also cases where mapping technology at the time simply resulted in a road being inside a boundary when the intent was to be outside. For the most part, however, roadless areas are primarily without roads and therefore provide uniquely different ecological and social values and opportunities as compared to other National Forest System lands. Maintaining these characteristics is the overall intent of the roadless rule.

According to current GIS mapping, a total of 114.40 miles of Forest Service roads are within Custer Gallatin Inventoried Roadless Areas, as well as 11.46 miles of decommissioned roads. Roads within inventoried roadless areas include:

- 4.21 miles of State/Federal highway,
- 2.40 miles of county jurisdiction roads,
- 90.68 miles of National Forest Service maintenance level 2 roads designed for high clearance,
- 20.83 miles of Forest Service maintenance level 3 roads suitable for passenger cars,
- 2.89 miles of maintenance level 4 roads suitable for a moderate degree of user comfort.

The boundaries of inventoried roadless areas cannot be changed through forest plan revision. Boundary modification is a separate process that would require rulemaking through the Forest Service Chief's office. The Roadless Area Conservation Rule generally prohibits construction or reconstruction of roads in inventoried roadless areas, but with some exceptions. The Roadless Area Conservation Rule allows the Forest Service line officer to authorize construction or reconstruction of a road in an inventoried roadless area if he or she determines it is needed for one of the following reasons:

- To protect public health and safety;
- To conduct environmental response under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or to conduct a restoration action under CERCLA, the Clean Water Act, or the Oil Pollution Act;
- To allow for reserved or outstanding rights or as provided for by statute or treaty;
- To prevent irreparable resource damage under certain circumstances;
- To implement a road safety improvement project under certain circumstances;
- When the secretary of agriculture has determined that a Federal aid highway project is in the public interest or is consistent with the purposes for which the land was reserved or acquired and no other reasonable and prudent alternative exists;
- When a road is needed in conjunction with mineral leases on lands that were under lease as of January 12, 2001 and were immediately extended upon the expiration of the leases.

The Roadless Area Conservation Rule generally prohibits the cutting, selling, or removal of timber in inventoried roadless areas of the National Forest System, but with some exceptions. The 2001 Roadless Area Conservation Rule allows Forest Service line officers to authorize the cutting, sale, or removal of generally small diameter timber when needed for one of the following purposes and the activity will maintain or improve roadless area characteristics:

- To improve endangered, proposed, or sensitive species habitat;
- To maintain or restore the characteristics of the ecosystem.
- The cutting, sale, or removal of timber is incidental to another activity that is not otherwise prohibited. The cutting, sale, or removal of timber is needed and appropriate for personal or administrative use; or
- The roadless characteristics of the area have already been substantially altered by road construction and timber cutting within certain parameters described in the 2001 Roadless Area Conservation Rule.

Table 156. Inventory roadless area acres by geographic area

Inventoried Roadless Area Name	Geographic Area	Acres
Cook Mountain	Ashland	9,621
King Mountain	Ashland	12,134
Tongue River Breaks	Ashland	17,481
Ashland Total Acreage	**Ashland Total Acreage**	**39,236**
Lost Water Canyon	Pryor Mountains	9,251
Lost Water Canyon RNA	Pryor Mountains	561
Mt. Gmt Area H	Pryor Mountains	611
Pryor Mountain Total Acreage	**Pryor Mountains Total Acreage**	**10,424**
Beartooth	Absaroka Beartooth Mountains	6,427
Black Butte	Absaroka Beartooth Mountains	871
Burnt Mountain	Absaroka Beartooth Mountains	10,698
Chico Peak	Absaroka Beartooth Mountains	10,744
Fishtail Saddleback	Absaroka Beartooth Mountains	16,359
Line Creek Plateau	Absaroka Beartooth Mountains	24,825
Mt Gmt Area H	Absaroka Beartooth Mountains	724
North Absaroka	Absaroka Beartooth Mountains	180,138
Proposed Line Creek PRNA	Absaroka Beartooth Mountains	389
Red Lodge Creek Hellroaring	Absaroka Beartooth Mountains	17,210
Reef	Absaroka Beartooth Mountains	2,500
Republic Mountain	Absaroka Beartooth Mountains	836
Rock Creek	Absaroka Beartooth Mountains	100
West Of Woodbine	Absaroka Beartooth Mountains	1,905
Absaroka Beartooth Mountains Total Acreage	**Absaroka Beartooth Mountains Total Acreage**	**273,727**
Box Canyon	Bridger, Bangtail, Crazy Mountains	2,292
Bridger	Bridger, Bangtail, Crazy Mountains	45,059
Crazy Mountain	Bridger, Bangtail, Crazy Mountains	82,093
Bridger, Bangtail, Crazy Mountains Total Acreage	**Bridger, Bangtail, Crazy Mountains Total Acreage**	**129,444**
Cabin Creek Wildlife Management Area	Madison, Henrys Lake, Gallatin Mountains	35,048
Dry Canyon	Madison, Henrys Lake, Gallatin Mountains	3,242
Gallatin Fringe	Madison, Henrys Lake, Gallatin Mountains	51,571
Hyalite-Porcupine-Buffalo Horn WSA	Madison, Henrys Lake, Gallatin Mountains	143,991
Lionhead	Madison, Henrys Lake, Gallatin Mountains	33,550
Madison	Madison, Henrys Lake, Gallatin Mountains	127,859
Madison, Henrys Lake, Gallatin Mountains Total Acreage	**Madison, Henrys Lake, Gallatin Mountains Total Acreage**	**395,260**
Total Forest Acreage	**(no data)**	**848,091**

Environmental Consequences

Current Plans

Management Direction under the Current Plans

The 1986 Custer Forest and the 1987 Gallatin Forest Plans were written before the 2001 Roadless Area Conservation Rule. Under the current plans, the 2001 Roadless Area Conservation Rule provides current direction.

Effects of the Current Plans

The inventory roadless areas would continue to be managed under the requirements of the 2001 Roadless Area Conservation Rule and compatible direction from the current forest plans. Table 157 below display the acreages and percentage of inventory roadless areas that are within other land allocations; some acreage of inventory roadless areas does not have additional allocations.

Table 157. Under the current plans, designations and land allocations within inventoried roadless areas

Forest Plan Land Allocation	Acres of inventoried roadless areas within each allocation	Percentage of inventoried roadless areas within each allocation
Recommended Wilderness	33,741	4
Eligible Wild and Scenic River Corridors ½ mile buffer	8,423	0
backcountry areas	N/A	N/A
Recreation Emphasis Areas	N/A	N/A
Stillwater Complex	N/A	N/A
Designation	**Acres of inventoried roadless areas within each designated areas**	**Percentage of inventoried roadless areas within each designated areas**
Wilderness Study Area	143,235	17
Cabin Creek Recreation and Wildlife Management Area	35,048	4
Research Natural Areas	21,542	3
Special Areas	none	none
National Natural Landmarks	none	none
Pryor Mt Wild Horse Territory	3,100	0.37
Earthquake Lake Geologic Area	27,866	3
Continental Divide National Scenic Trail ½ mile buffer	2,565	0.30
Designated Wild and Scenic River Corridors	none	none
Alternative A Low Development Areas	39,236	5
Inventoried Roadless Areas with no other designations	431,929	51

Alternative A represents the current plans' future projections if kept

Table 158. Under the current plans summer recreation opportunity spectrum (ROS) class within inventoried roadless areas

ROS Class	Acres	Percent
Rural	31,192	3.68
Roaded Natural	36,762	4.33
Semi-Primitive Motorized	183,657	21.66
Semi-Primitive Nonmotorized	584,379	68.91
Primitive	6,273	0.74
No ROS Assigned- GIS coverage gaps	5,827	0.69
Total	848,091	100

Table 159. Under the current plans, winter recreational opportunity spectrum (ROS) class within inventoried roadless areas

ROS Class	Acres	Percent
Rural	27,612	3.26
Roaded Natural	33,564	3.96
Semi-Primitive Motorized	318,151	37.51
Semi-Primitive Nonmotorized	462,542	54.54
Primitive	395	0.05
No ROS Assigned- GIS coverage gaps	5,827	0.69
Total	848,091	100

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

The inventory roadless areas would continue to be managed under the requirements of the 2001 Roadless Area Conservation Rule and a revised plan desired condition for primitive and semi-primitive recreation settings.

Inventory roadless areas may also have other designations, such as wilderness study area or research natural area. The location of inventory roadless areas with respect to designations such as wilderness study area or research natural area does not change by any of the alternatives. Where allocations overlap, the more protective components would apply. All overlapping allocations and designations are shown in table 160 through table 171.

Effects of the Revised Plan Alternatives

Inventory roadless areas may be overlain with forest plan land allocations that vary by alternative. Table 160, table 163, table 166, and table 169 display the acreages and percentage of inventory roadless areas that are within other land allocations by revised plan alternative. All revised plan alternatives have some acreage of inventory roadless areas that do not have additional allocations. Where allocations overlap, the more protective components would apply. Due to overlapping allocations and rounding, percentages may exceed 100 percent.

Table 160. Alternative B designations and land allocations within inventoried roadless areas

Forest Plan Land Allocations	Acres of inventoried roadless areas within each allocation	Percentage of inventoried roadless areas within each allocation
Recommended Wilderness	111,953 acres	13 percent
Eligible Wild and Scenic River Corridors ½ mile buffer	21,745 acres	3 percent
Backcountry areas	81,240 acres	10 percent
Recreation Emphasis Areas	48,838 acres	6 percent
Stillwater Complex	57,563 acres	7 percent
Designations	**Acres of inventoried roadless areas within each designation**	**Percentage of inventoried roadless areas within each designation**
Wilderness Study Area	143,235 acres	17 percent
Cabin Creek Recreation and Wildlife Management Area	35,048 acres	4 percent
Research Natural Areas	21,542 acres	3 percent
Special Areas	none	none
National Natural Landmarks	none	none
Pryor Mt Wild Horse Territory	3,100 acres	0.37 percent
Earthquake Lake Geologic Area	27,866	3 percent
Continental Divide National Scenic Trail ½ mile buffer	2,565 acres	0.30 percent
Designated Wild and Scenic River Corridors	none	none
Inventoried Roadless Areas with no other allocations	265,613 acres	31 percent

Table 161. Alternative B Summer recreational opportunity spectrum (ROS) class within inventoried roadless areas

ROS Class	Acres	Percent
Rural	30,936	4
Roaded Natural	34,633	4
Semi-Primitive Motorized	180,347	21
Semi-Primitive Nonmotorized	590,268	70
Primitive	6,081	0.7
No ROS Assigned- GIS coverage gaps	5,827	0.7
Total	848,091	100

Table 162. Alternative B winter recreational opportunity spectrum (ROS) class within inventoried roadless areas

ROS Class	Acres	Percent
Rural	27,445	3
Roaded Natural	33,349	4
Semi-Primitive Motorized	316,334	37
Semi-Primitive Nonmotorized	464,928	55
Primitive	209	0.02
No ROS Assigned- GIS coverage gaps	5,827	0.7
Total	848,091	100

Table 163. Alternative C designations and land allocations within inventoried roadless areas

Forest Plan Land Allocation	Acres of inventoried roadless areas within each allocation	Percentage of inventoried roadless areas within each allocation
Recommended Wilderness	142,848 acres	17 percent
Eligible Wild and Scenic River Corridors ½ mile buffer	21,745 acres	3 percent
Backcountry areas	192,827 acres	23 percent
Recreation Emphasis Areas	65,602 acres	8 percent
Stillwater Complex	57,563 acres	7 percent
Designation	**Acres of inventoried roadless areas within each designation**	**Percentage of inventoried roadless areas within each designation**
Wilderness Study Area	143,235 acres	17 percent
Cabin Creek Recreation and Wildlife Management Area	35,048 acres	4 percent
Research Natural Areas	21,542 acres	3 percent
Special Areas	none	none
National Natural Landmarks	none	none
Pryor Mt Wild Horse Territory	3,100 acres	0.37 percent
Earthquake Lake Geologic Area	27,866 acres	3 percent
Continental Divide National Scenic Trail ½ mile buffer	2,565 acres	0.30 percent
Designated Wild and Scenic River Corridor	none	none
Inventoried Roadless Areas with no other allocations	106,443 acres	13 percent

Table 164. Alternative C summer recreational opportunity spectrum (ROS) class within inventoried roadless areas

ROS Class	Acres	Percent
Rural	29,367	3
Roaded Natural	32,440	4
Semi-Primitive Motorized	164,365	19
Semi-Primitive Nonmotorized	467,120	55
Primitive	149,007	18
No ROS Assigned- GIS coverage gaps	5,793	0.68
Total	848,091	100

Table 165. Alternative C winter recreational opportunity spectrum (ROS) class within inventoried roadless areas

ROS Class	Acres	Percent
Rural	25,732	3
Roaded Natural	31,857	4
Semi-Primitive Motorized	298,225	35
Semi-Primitive Nonmotorized	343,202	40
Primitive	143,249	17
No ROS Assigned- GIS coverage gaps	5,793	0.7
Total	848,091	100

Table 166. Alternative D designations and land allocations within inventoried roadless areas

Forest Plan Land Allocation	Acreage of inventoried roadless areas within each allocation	Percentage of inventoried roadless areas within each allocation
Recommended Wilderness	622,524 acres	73 percent
Eligible W&S River Corridors	21,745	3 percent
Backcountry areas	none	none
Recreation Emphasis Areas	8,703 acres	1 percent
Stillwater Complex	N/A	N/A
Designation	**Acres of inventoried roadless areas within each designation**	**Percentage of inventoried roadless areas within each designation**
Wilderness Study Area	143,235 acres	17 percent
Cabin Creek Recreation and Wildlife Management Area	35,048 acres	4 percent
Research Natural Areas	21,542 acres	3 percent
Special Areas	none	none
National Natural Landmarks	none	none
Pryor Mt Wild Horse Territory	3,100 acres	0.37 percent
Earthquake Lake Geologic Area	27,866 acres	3 percent
Continental Divide National Scenic Trail	2,565 acres	0.30 percent
Designated W&S River Corridors	none	none
Inventoried Roadless Areas with no other allocations	169,536 acres	20 percent

Table 167. Alternative D summer recreational opportunity spectrum (ROS) class within inventoried roadless areas

ROS Class	Acres	Percent
Rural	27,948	3
Roaded Natural	33,235	4
Semi-Primitive Motorized	89,825	11
Semi-Primitive Nonmotorized	66,751	8
Primitive	624,506	74
No ROS Assigned- GIS coverage gaps	5,827	0.7
Total	848,091	100

Table 168. Alternative D winter recreational opportunity spectrum (ROS) class within inventoried roadless areas

ROS Class	Acres	Percent
Rural	25,278	3
Roaded Natural	23,459	3
Semi-Primitive Motorized	119,698	14
Semi-Primitive Nonmotorized	50,976	6
Primitive	622,854	74
No ROS Assigned- GIS coverage gaps	5,827	0.7
Total	848,091	100

Table 169. Alternative E designations and land allocations within inventoried roadless areas

Forest Plan Land Allocation	Acreage of inventoried roadless areas within each allocation	Percentage of inventoried roadless areas within each allocation
Recommended Wilderness	N/A	N/A
Eligible Wild and Scenic River Corridors	21,745 acres	3 percent
backcountry areas	172,278 acres	20 percent
Recreation Emphasis Areas	39,307 acres	5 percent
Stillwater Complex	57,563 acres	7 percent
Designation	**Acreage of inventoried roadless areas within each designation**	**Percentage of inventoried roadless areas within each designation**
Wilderness Study Area	143,235 acres	17 percent
Cabin Creek Recreation and Wildlife Management Area	35,048 acres	4 percent
Research Natural Areas	21,542 acres	3 percent
Special Areas	none	none
National Natural Landmarks	none	none
Pryor Mt Wild Horse Territory	3,100 acres	0.37 percent
Earthquake Lake Geologic Area	27,866 acres	3 percent
Continental Divide National Scenic Trail	2,565 acres	0.30 percent
Designated Wild and Scenic River Corridors	none	none
Inventoried Roadless Areas with no other allocations	494,339	58 percent

Table 170. Alternative E summer recreational opportunity spectrum (ROS) class within inventoried roadless areas

ROS Class	Acres	Percent
Rural	31,926	4
Roaded Natural	36,888	4
Semi-Primitive Motorized	194,089	23
Semi-Primitive Nonmotorized	573,273	68
Primitive	6,087	0.7
No ROS Assigned- GIS coverage gaps	5,827	0.7
Total	848,091	100

Table 171. Alternative E winter recreational opportunity spectrum (ROS) class within inventoried roadless areas

ROS Class	Acres	Percent
Rural	27,989	3
Roaded Natural	33,153	4
Semi-Primitive Motorized	324,015	38
Semi-Primitive Nonmotorized	456,898	54
Primitive	209	0.02
No ROS Assigned- GIS coverage gaps	5,827	0.7
Total	848,091	100

Consequences to Inventoried Roadless Areas from Forest Plan Components Associated with Other Resource Programs or Management Activities

Effects from Timber and Vegetation Management

In all alternatives, inventory roadless areas are not suitable for timber production, but timber harvest and vegetation management may occur for other resource purposes. As outlined in the 2001 Roadless Area Conservation Rule, timber harvest would consist of cutting small diameter trees. Plan components associated with timber harvest would ensure that all resource protection measures are met.

Effects from Fire and Fuels Management

In all alternatives, plan components for fire and fuels management would encourage an appropriate management response to wildfires that may occur within inventory roadless areas, and provide opportunities for natural fire to promote and/or enhance the ecological attributes of these areas.

Effects from Watershed, Riparian, and Aquatic Management

The revised plan alternatives provide more detailed guidance than the current plans for protection of watersheds, riparian areas, and aquatic habitats. The revised plan alternatives include the adoption of riparian management zones, which are greater in size from the riparian zones currently identified for streams east of the Continental Divide. Revised plan alternative plan components and objectives for aquatic ecosystems would complement the overall management of the inventory roadless areas by promoting the ecological integrity of watersheds, riparian areas, and aquatic habitats.

Effects from Wildlife Management

In alternatives B, C and D (where located within inventory roadless areas) plan components for key linkage areas would add additional restrictions to activities otherwise allowed. Permanent facilities and/or structures, such as trails, fences, administrative or recreational developed sites, etc. should not be constructed in key linkage areas, unless needed to address ongoing or imminent resource issues. Low level helicopter flights may also be restricted, which is not addressed in the Roadless Area Conservation Rule. Current plans and alternative E are not restricted by key linkage areas.

Effects from Access Management

In all alternatives, plan components related to road access and infrastructure would have little effect on inventory roadless areas, because these areas are generally unroaded. However, where roads do occur, road maintenance activities may occur and would be guided by road access and infrastructure plan components which include protections for other resources. The 2001 Roadless Area Conservation Rule further guides and constrains road construction or reconstruction.

Effects from Recreation Management

In all alternatives, plan components for recreation settings, opportunities, and access would complement the management of inventory roadless areas (IRAs). In the revised plan alternatives, inventory roadless areas have a primitive or semi-primitive recreational opportunity spectrum setting, except for fringe areas where there is an effect from adjacent buffers. These classifications would ensure that potential recreation activities would be consistent with IRA desired conditions.

Effects from Permitted Livestock Grazing Management

While improper livestock grazing itself has the potential to degrade plant communities, through factors such as invasive plant spread and damage to riparian areas, revised plan alternative plan components emphasize the maintenance of resilient native plant communities as well as desirable riparian area conditions. The revised plan alternatives provide more detailed guidance than the current plans for resilient native plant communities and riparian areas that should help protect the ecological integrity of inventoried roadless areas.

Effects from Energy and Minerals Management

All inventoried roadless areas on the Custer Gallatin were established as a part of the 2001 Roadless Area Conservation Rule. Roadbuilding for leasable and salable mineral development would not be allowed in these areas. However, locatable mineral development is allowable within inventoried roadless areas, which could affect the generally low development character of these areas. Potential impacts would be reduced by direction in all alternatives that mineral and energy resource development consider other resource values.

Cumulative Effects

The 848,000 acres of inventoried roadless areas on the Custer Gallatin are part of a nationwide system of 58.5 million acres of inventoried roadless areas. When combined with designated wilderness, the 848,000 acres of inventoried roadless areas contribute to about two thirds of the Custer Gallatin allocated to primitive and roadless character. Inventoried roadless areas continue to provide opportunities for many types of resource restoration projects, along with motorized and mechanized trails.

Conclusion

The inventoried roadless area boundaries and acreages are established as a part of the 2001 Roadless Area Conservation Rule and would not change in any alternative. These lands would continue to be managed under the guidance established by the 2001 Roadless Area Conservation Rule, with more restrictive guidance provided by additional designations or land allocations.

3.21.7 Research Natural Areas

Affected Environment (Existing Condition)

The Custer Gallatin contains 10 established research natural areas, which total 29,650 acres. All are administratively designated areas, which are defined as an area identified and managed to maintain its unique special character or purpose (36 CFR 219.19). The existing conditions and effects by alternative for these designated area categories are discussed in this section.

Research natural areas are permanently established to represent the range of vegetation types and areas of special ecological significance on national forest lands. These protective designations are made with the goal of maintaining natural ecosystem components and processes. The RNAs are identified and administratively designated by the Regional Forester with concurrence of the research station director, and serve as baseline areas for non-manipulative research, education, and the maintenance of biodiversity. In some cases, stewardship management is needed to maintain or restore the target plant communities in research natural areas, including actions such as invasive weed control or prescribed fire. These management activities are also coordinated between the national forests and the research station.

The Code of Federal Regulations (36 CFR 251.23) directs the Forest Service to establish research natural areas typifying important forest, shrubland, grassland, alpine, and aquatic ecosystems. In addition to their value as reference areas for research and monitoring, research natural areas help maintain biological diversity. This is done by conserving assemblages of common and rare species, plant communities relatively undisturbed by human actions and unique landscape features. The 1983 Northern Region Guide (USDA 1983) included a matrix of habitat types, community types, and aquatic features targeted for inclusion in the Northern Region's Research Natural Area system. Major revision of this 1983 regional guide for research natural areas was completed in 1996 (Chadde et al. 1996), giving new targeted plant communities and other features for inclusion in research natural areas (forest plan, appendix A). No new research natural areas are proposed in the forest plan.

Designated research natural areas are those that have been formally established by a decision signed by the Regional Forester, with concurrence of the research station director, after being vetted through the forest and Rocky Mountain Research Station via forest planning, during revision or by amendment. Proposed research natural areas have been vetted through the Custer Gallatin National Forest and Rocky Mountain Research station via forest planning (either in revision or by amendment), but they have not been established by a Regional Forester decision. Candidate research natural areas have not been fully vetted by the Custer Gallatin and Rocky Mountain Research station and have not been included in a forest plan decision.

The Custer Gallatin National Forest has 10 designated research natural areas and two candidate research natural areas (table 172).

Table 172. Research natural areas (RNAs), locations, status and acres

Name	Geographic Area	Status	Acres
Black Butte RNA	Madison, Henrys Lake, Gallatin Mountains	Designated in 1998	510
Obsidian Sands RNA	Madison, Henrys Lake, Gallatin Mountains	Designated in 1997	390
Palace Butte RNA	Madison, Henrys Lake, Gallatin Mountains	Designated in 1997	1,280
Wheeler Ridge RNA	Madison, Henrys Lake, Gallatin Mountains	Designated in 1997	640
East Fork of Mill Creek RNA	Absaroka-Beartooth Mountains	Designated in 1997	882
Passage Creek RNA	Absaroka-Beartooth Mountains	Designated in 1997	1,112
Sliding Mountain RNA	Absaroka-Beartooth Mountains	Designated in 1997	1,459
Line Creek Plateau RNA (Custer Gallatin National Forest Beartooth RD, MT) (Shoshone NF Clark's Fork RD, WY)	Absaroka-Beartooth Mountains	Designated in 2008	22,422 (19,369 acres Custer Gallatin NF) (3,053 acres Shoshone NF)
Lost Water Canyon	Pryor Mountains	Designated in 1994	3,645
Poker Jim RNA	Ashland	Designated in 1974	363
Deer Draw	Sioux	Candidate	Undetermined – approx. 15 Ac
White Rock Springs	Sioux	Candidate	Undetermined - approx. 60 Ac
Total Designated RNA Acres	Not applicable	Not applicable	29,650 Custer Gallatin NF Acres

RD = ranger district; NF = national forest

Black Butte Research Natural Area

The Black Butte Research Natural Area is located on the Hebgen Lake Ranger District. This research natural area is characterized by large, sometimes multiple-stemmed whitebark pine, dry subalpine fir, and Idaho fescue habitat types. Elevation ranges from about 6900 to 8,900 feet.

Obsidian Sands Research Natural Area

The Obsidian Sands Research Natural Area is located on the Hebgen Lake Ranger District. This research natural area is characterized by lodgepole pine, bitterbrush habitat type on obsidian sand benchland. Elevation ranges from about 6,560 to 6,600 feet. The majority of the research natural area experienced stand replacing wildfire with moderate soil burn severity from the 2007 Madison Arm Fire.

Palace Butte Research Natural Area

The Palace Butte Research Natural Area is located on the Bozeman Ranger District. This research natural area is characterized by subalpine wetlands, waterfalls, geologic features, subalpine forest, and meadows. Nearly all of the forested area of the research natural area is within the subalpine fir and spruce habitats. Various shrub and herbaceous species occupy riparian sites such as wet meadows. Elevation ranges from about 7,200 to 10,300 feet.

Wheeler Ridge Research Natural Area

The Wheeler Ridge Research Natural Area is located on the Bozeman Ranger District. The research natural area features upland forests dominated by subalpine fir and old growth whitebark pine. Elevation ranges from about 7,800 to 8,700 feet.

East Fork of Mill Creek Research Natural Area

The East Fork of Mill Creek Research Natural Area is located on the Yellowstone Ranger District. This research natural area is characterized by Engelmann spruce and Douglas-fir with whitebark pine understory. Elevation ranges from about 5,900 to 8,200 feet. The eastern half of the research natural area experienced moderate to high burn severity from the 2007 Wicked Creek Fire.

Passage Creek Research Natural Area

The Passage Creek Research Natural Area is located on the Yellowstone Ranger District. This research natural area is characterized by Engelmann spruce, Douglas-fir, and subalpine fir upland and riparian forests. Elevation ranges from about 6,400 to 8,900 feet. About two thirds of the research natural area experienced moderate to high burn severity from the 2007 Wicked Creek Fire.

Sliding Mountain Research Natural Area

The Sliding Mountain Research Natural Area is located on the Yellowstone Ranger District. This research natural area is characterized by watersheds of two first-order drainages. Most of the research natural area is forested, primarily by spruce, subalpine fir, lodgepole pine, and Douglas-fir. A sizable shrubland and grassland is present. Dominant species include mountain big sagebrush, Idaho fescue, and bluebunch wheatgrass. Several avalanche chutes occur on the north face of Sliding Mountain. Elevation ranges from about 6,300 to 9,300 feet.

Line Creek Plateau Research Natural Area

The Line Creek Plateau Research Natural Area was established as a landscape scale research natural area and consists of lands managed by the Custer Gallatin and Shoshone National Forests. This research natural area is characterized by extensive areas of alpine tundra vegetation, a cirque basin with alpine lakes and ponds, and many unique plant species. It is the easternmost, warmest alpine plateau in the Beartooth Mountains. The area is composed of alpine snowbeds, alpine wetlands, alpine turf, alpine cushion plants (compact, low growing, mat forming plants), alpine grasslands, conifer forests, and shrublands. Of the 21 vegetation types, 17 meet research natural area network-targeted vegetation types (nine alpine, seven coniferous, and one shrubland). There are several rare plant species and many plant species that are disjunct from the main portion of their range in the arctic. Sorted stone circles and stripes, frost hummocks, frost boils, and solifluction terraces exist from freeze-thaw processes. Elevation ranges from about 7,400 to 10,900 feet. The majority of the forested portions on the east flank of the research natural area experienced high burn severity from the 2011 Hole-in-the-Wall Fire.

An area-wide restriction within the Line Creek Plateau Research Natural Area (outside of Highway 212, 250-foot centerline easement and Line Creek Trailhead) prohibits all motorized use, including snowmobiles. However, snowmobile access to play areas outside of the research natural area (for example, Gardner Headwall, Top of the World, and Cooke City area) is allowed through Highway 212's 250-foot centerline easement.

Lost Water Canyon Research Natural Area

The Lost Water Canyon Research Natural Area is located on the Beartooth Ranger District. The primary objectives of the research natural area are to maintain its plant communities, rare plant populations, and geologic features in a natural condition. The research natural area may serve as a baseline area for monitoring long-term ecological changes, especially in those communities dominated by Douglas-fir, found here near its eastern limit, and in subalpine grasslands. The research natural area serves as an intact watershed for study of limestone bedrock hydrology, featuring an interrupted stream system. The research natural area also provides a protected site for long-term monitoring of a large population of the regionally endemic plant Shoshonea pulvinata, subalpine forest and meadows and depauperate Douglas-fir habitats. Elevation ranges from about 5,100 to 8,700 feet.

Poker Jim Research Natural Area

The Poker Jim Research Natural Area is located on the Ashland Ranger District. This research natural area is characterized by a mixture of ponderosa pine, sagebrush-grass, and grassland habitat types. Elevation ranges from about 3,500 to 5,100 feet.

White Rock Springs Candidate Research Natural Area

White Rock Springs on the Montana portion of the Sioux Ranger District was listed in the 1986 Custer Forest Plan as a candidate research natural area to represent beaver pond aquatic type in Montana. This candidate research natural areas was not pursued for designation. No records have been located for this candidate area. In addition, White Rock Springs was not identified in the Northern Region 1996 review of underrepresented types (Chadde et al. 1996). The category of “ponds” are the current classification in which beaver ponds fit. There are currently 19 Northern Region Research Natural Areas that have ponds less than 20 acres (Chadde et al. 1996). White Rock Springs is recommended for removal as a candidate research natural area during forest plan revision.

Deer Draw Candidate Research Natural Area

Deer Draw on the South Dakota portion of the Sioux District was originally proposed as a candidate research natural area in 1982 to protect the habitat of two small mammal (white-footed mouse and meadow jumping mouse) as indicated in the 1986 Custer Forest Plan showing “special faunal populations” as being the targeted element of interest. This candidate research natural area was not pursued for designation. Currently the state of South Dakota does not consider either species as rare and neither species is a Northern Region sensitive species. Since then, Deer Draw candidate Research Natural Area was reviewed for community types as targeted in the 1993-1996 regional review of underrepresented community types. The targeted community types include green ash forest and woodland alliance, ponderosa pine forest, and mixed-grass pine savanna, all of which occur in the Deer Draw. The Deer Draw area is in the road draw allotment which has received livestock use since the turn of the 20th century and conditions are not considered pristine or near pristine which is a selection criteria for research natural areas. There are currently no Forest Service natural area examples of the Green Ash Forest & Woodland Alliance, but sites dominated by green ash are present in several United States Fish and Wildlife Service Research Natural Areas along the Missouri River in eastern Montana (Chadde et al. 1996). Deer Draw is recommended for removal as a candidate research natural area during forest plan revision.

Environmental Consequences

Current Plans

Management Direction under the Current Plans

Management direction for Custer Research Natural Areas are found under management area L and other overlapping management areas such as H and I, and for Gallatin Research Natural Areas direction is found under management area 21. The management goal for research natural areas are to provide non-manipulative research, observation, and study of undisturbed ecosystems which typify important forest, shrubland, grassland, alpine, and aquatic communities.

The following standards apply to both forest plan's research natural area management areas: management of research natural areas in wilderness will be consistent with wilderness and recommended wilderness goals. Wildlife habitat improvements are not permitted. Generally, permitted livestock grazing is not allowed, however, where establishment records or decision orders indicate, incidental grazing may be tolerated. Research natural areas are classified as unsuitable for timber production. No measures will generally be undertaken for insect and disease management unless epidemic populations exist and adjacent lands are severely threatened. Recreation use is generally not encouraged and can be restricted or prohibited if such use threatens or interferes with the purposes for which the research natural area was established. New trails will not be constructed within these areas. Applications for special use permits will be evaluated on a case-by-case basis. No special use occupancy will be permitted. No new range improvement construction will be permitted except along the research natural area boundary. One or more fire management strategies may be considered and implemented for any unplanned wildland fire to achieve a variety of resource management objectives, while minimizing negative effects to life, investments and valuable resources. Fire management strategies for unplanned wildland fire will be responsive to the goals and objectives described for each management area as specified in the forest plan. Prescribed fire may be used to perpetuate the natural diversity of plant communities.

Effects of the Current Plans

Both current plans limit most management activities from occurring in these areas, with the exception of prescribed fire and invasive plant control with concurrence from Rocky Mountain Research Station Director. Expected effects to the research natural area (RNAs) are minimal. Most of the research natural areas are remote with few to no trails. Recreational hiking or horseback use varies by research natural area.

Line Creek Plateau Research Natural Area specifically restricts motorized vehicle use to only Highway 212 and to Line Creek Trailhead (Road 2124) parking area; restricts snowmobile use to only the 250 centerline easement of Highway 212; limits mountain biking to use to only system trails; prohibits hitching, tethering, or picketing horses or other recreational livestock within 200 feet of a stream or other free-flowing water; and prohibits camping (including building a fire, other than fires confined to liquid fuel stoves) within 200 feet of any lakeshore or 100 feet of any live stream or free-flowing water.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

Research natural area management direction under alternatives B through E would essentially be the same as the current plans. Specific plan components for decisions made for the Line Creek Plateau RNA that go beyond forestwide plan components are found in the Absaroka-Beartooth geographic area section.

Effects of the Revised Plan Alternatives

Under the revised plan alternatives, all ten research natural areas would be retained as currently established. Deer Creek and White Rock Springs candidate Research Natural Areas would be removed as candidate research natural areas under all revised plan alternatives due to less than pristine conditions as well as their features being represented in other established research natural areas. Woody draws represent several United States Fish and Wildlife Service Research Natural Areas along the Missouri River in eastern Montana and 19 Northern Region Research Natural Areas have pond features (Chadde et al. 1996). New candidate research natural areas meeting selection criteria could be considered in the future based upon local knowledge of vegetation types or identified rare elements and features.

Management direction for the research natural areas would be the same as in the existing plans and there would be no notable difference in potential effects, which is the protection of the values associated with the research natural areas.

Consequences to Research Natural Areas from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Vegetation and Timber Management

Under all alternatives, research natural areas are not suitable for timber production. Timber harvest, firewood gathering, and other vegetation management activities (such as prescribed fire) may only be allowed to maintain or achieve the desired conditions and purpose for the research natural area. The existing forest plans prohibit timber harvest for any purpose in these areas, and therefore timber management should have no effect. Timber harvest activities that occur on the broader landscape could influence the type and severity of wildfire that enters research natural areas.

Vegetation management activities may occur as guided and restricted by plan components, regulation, and policy. These measures are expected to protect all qualities associated with these areas and to achieve desired conditions.

The revised plan alternatives allow that some vegetation treatments could occur where consistent with site establishment records and plans. Within research natural areas (RNAs), the research station director (with the concurrence of the forest supervisor) may authorize management practices that are necessary for invasive weed control or to preserve the vegetation for which the research natural areas was created (Forest Service Manual 4063.3). As stated in the manual, limited use of vegetation management may occur within research natural areas, in situations where the vegetative type would be lost or degraded without management. The criterion states management practices must provide a closer approximation of the naturally occurring vegetation and the natural processes governing the vegetation than would be possible without management. These practices may include prescribed burning. Vegetation management, including timber harvest, may occur in the RNAs if needed for restoration, study, or research purposes. Timber harvesting for other purposes (for example fuel reduction or salvage) may also occur in research natural areas, but must be coordinated and agreed upon with the Rocky Mountain Research Station.

Any activities that may occur would have minimal impact to vegetation conditions, or be designed to maintain or restore natural conditions. Timber harvest and other vegetation management activities that occur on the broader landscape could influence the type and severity of wildfire that enters research natural areas.

Effects from Fire and Fuels Management

Desired conditions for research natural areas in the revised plan alternatives state these lands are generally natural appearing, with natural processes (including fire) functioning naturally with limited human influences. One of the purposes of research natural areas are to serve as baseline areas for the study of these processes and their effects on ecosystems. Management of wildland fire in or near research natural areas would be guided by these revised plan alternatives components. Additional guidance would come from each individual research natural area's establishment record, the Forest Service manual, other regulatory documents, and consultation with Rocky Mountain Research Station scientists.

Plan components for wildland fire could affect research natural areas. Fire is a primary natural ecosystem process, and all alternatives emphasize the importance of allowing such processes to occur. Prescribed fire and fire suppression tactics would adhere to site establishment records and Forest Service manual 4063, which ensure that natural fires are allowed to burn only within a prescription designed to accomplish objectives specific to the research natural area. Further, fires that occur on the broader landscape could influence the type and severity of wildfire that enters research natural areas.

Fires suppression direction from the Custer Forest Plan is to confine, contain, and control wildfires at research natural areas. The Gallatin Forest Plan considers multiple fire management strategies. Revised plan alternative plan components for fire and fuels management would encourage an appropriate management response to wildfires that may occur in research natural areas, and provide opportunities for natural fire to alter the vegetation condition of the landscape. Fire on the landscape would generally complement the desire for natural ecological processes within these areas. Plan components are in place to ensure that minimum impact suppression tactics or other tactics appropriate for the protection of the values are used.

If the values associated with the research natural area are at risk of degradation or loss due to fire, fire management strategies would likely include measures aimed at protecting those values, if possible. On the other hand, fire as a natural process may be desired and allowed to occur within a research natural area to perpetuate the natural functioning of the ecosystem. In either case, the effects from fire and fire management strategies are expected to have a positive effect on the condition and perpetuation of the ecological values associated with the research natural areas.

Effects from Watershed, Riparian, and Aquatic Management

The revised plan alternatives provide more detailed guidance than the current plans for protection of watersheds, riparian areas, and aquatic habitats. The revised plan alternatives include the adoption of riparian management zones, which are greater in size from the riparian zones currently identified for streams east of the Continental Divide. Revised plan alternative plan components and objectives for aquatic ecosystems would complement the overall management of the research natural area by promoting the ecological integrity of watersheds, riparian areas, and aquatic habitats.

Under all revised plan alternatives, the following conservation watershed network watersheds are within research natural areas:

- 1,280 acres of the Upper Hyalite Creek Conservation Watershed Network are within the Palace Butte Research Natural Area
- 882 acres of the East Fork Mill Creek Conservation Watershed Network are within the East Fork Mill Creek Research Natural Area
- 1,112 acres of the Passage Creek Conservation Watershed Network are within the Passage Creek Research Natural Area
- 3, 645 acres of the Lost Water Canyon Creek Conservation Watershed Network are within the Lost Water Canyon Research Natural Area

Activities related to conservation watershed networks must meet applicable standards and guidelines for research natural areas. Within the restrictions of revised plan alternative plan components and policy direction, the expected effects are minimal.

Activities related to watershed, riparian, or aquatic habitat would generally not occur in research natural areas, and there would be little to no effect related to the management of these resources.

Effects of Land Allocations

Obsidian Sands and Wheeler Ridge Research Natural Areas do not overlap with any wilderness areas, wilderness study areas, or recommended wilderness areas under any alternative. All other established research natural areas have some level of overlap and varies by alternative. Black Butte, East Fork Mill Creek, Passage Creek, and Sliding Mountain Research Natural Areas do not overlap with any inventoried roadless areas, eligible wild and scenic rivers, backcountry areas, or recreation emphasis areas under any alternative. All other established research natural area have some level of overlap and varies by alternative (table 173 and table 174).

When research natural areas fall within congressionally designated areas, such as designated wilderness areas or wilderness study areas, research natural area activities must meet the applicable congressionally designated area statutory mandates (FSM 4063.32 and FSM 1920) and forest plan direction. Similarly, research natural area activities would meet revised plan alternative components for recommended wilderness areas.

Activities related to other land allocations that vary by alternative (such as inventoried roadless areas, eligible wild and scenic rivers, backcountry areas, and recreation emphasis areas) must meet applicable standards and guidelines for research natural areas.

Revised plan alternative protocol for overlapping land allocations state that the more restrictive guidance would apply and that there would be little to no effect from research natural areas activities in overlapping wilderness areas, wilderness study areas, or recommended wilderness areas. As such, the overlapping research natural areas compatible with the designated wilderness areas, wilderness study areas, and recommended wilderness areas and the remaining overlapping land allocations are compatible with the established research natural areas. The following two tables list land allocation overlaps with established research natural areas under all alternatives.

Table 173. Overlapping land allocations where research natural area (RNA) activities must also meet other land allocation forest plan constraints

Name	Current Plans	Alternative B	Alternative C	Alternative D	Alternative E
Black Butte RNA (510 Acres)	The entire research natural area is within the Lee Metcalf Wilderness Area	The entire research natural area is within the Lee Metcalf Wilderness Area	The entire research natural area is within the Lee Metcalf Wilderness Area	The entire research natural area is within the Lee Metcalf Wilderness Area	The entire research natural area is within the Lee Metcalf Wilderness Area
Palace Butte RNA (1,280 Acres)	The entire research natural area is within the Hyalite – Porcupine - Buffalo Horn Wilderness Study Area.	The entire research natural area is within the Hyalite – Porcupine - Buffalo Horn Wilderness Study Area.	The entire research natural area is within the Hyalite – Porcupine - Buffalo Horn Wilderness Study Area.	The entire research natural area is within the Hyalite – Porcupine - Buffalo Horn Wilderness Study Area.	The entire research natural area is within the Hyalite – Porcupine - Buffalo Horn Wilderness Study Area.
East Fork of Mill Creek RNA (882 Acres)	The entire research natural area is within the Absaroka-Beartooth Wilderness Area.	The entire research natural area is within the Absaroka-Beartooth Wilderness Area.	The entire research natural area is within the Absaroka-Beartooth Wilderness Area.	The entire research natural area is within the Absaroka-Beartooth Wilderness Area.	The entire research natural area is within the Absaroka-Beartooth Wilderness Area.
Passage Creek RNA (1,112 Acres)	About 720 acres of this research natural area is within the Absaroka-Beartooth Wilderness Area.	About 720 acres of this research natural area is within the Absaroka-Beartooth Wilderness Area.	About 720 acres of this research natural area is within the Absaroka-Beartooth Wilderness Area.	About 720 acres of this research natural area is within the Absaroka-Beartooth Wilderness Area.	About 720 acres of this research natural area is within the Absaroka-Beartooth Wilderness Area.
Sliding Mountain RNA (1459 Acres)	The entire research natural area is within the Absaroka-Beartooth Wilderness Area.	The entire research natural area is within the Absaroka-Beartooth Wilderness Area.	The entire research natural area is within the Absaroka-Beartooth Wilderness Area.	The entire research natural area is within the Absaroka-Beartooth Wilderness Area.	The entire research natural area is within the Absaroka-Beartooth Wilderness Area.
Line Creek Plateau RNA (CGNF 19,369 Acres) (SNF 3,053 Acres)	About 1,321 acres of this research natural area is within the Absaroka-Beartooth Wilderness Area. About 392 acres of the research natural area is within the Line Creek Plateau Recommended Wilderness Area.	About 1,321 acres of this research natural area is within the Absaroka-Beartooth Wilderness Area. About 392 acres of the research natural area is within the Line Creek Plateau Recommended Wilderness Area.	About 1,321 acres of this research natural area is within the Absaroka-Beartooth Wilderness Area. About 392 acres of the research natural area is within the Line Creek Plateau Recommended Wilderness Area.	About 1,321 acres of this research natural area is within the Absaroka-Beartooth Wilderness Area. About 16,127 acres of the research natural area is within the Line Creek Plateau Recommended Wilderness Area.	About 1,321 acres of this research natural area is within the Absaroka-Beartooth Wilderness Area.
Lost Water Canyon RNA (3,645 Acres)	The entire research natural area is within the Lost Water Canyon Recommended Wilderness Area.	The entire research natural area is within the Lost Water Canyon Recommended Wilderness Area.	The entire research natural area is within the Lost Water Canyon Recommended Wilderness Area.	The entire research natural area is within the Lost Water Canyon Recommended Wilderness Area.	N/A
Poker Jim RNA (363 Ac)	N/A	N/A	N/A	The entire research natural area is within the Tongue River Breaks Recommended Wilderness Area.	N/A

Table 174. Overlapping land allocations where other land allocation activities must also meet research natural area (RNA) forest plan constraints

Name	Current Plans	Alternative B	Alternative C	Alternative D	Alternative E
Obsidian Sands RNA (390 Ac)	390 acres of the Hebgen Winter Recreation Emphasis Area are within the research natural area.	390 acres of the Hebgen Winter Recreation Emphasis Area are within the research natural area.	390 acres of the Hebgen Winter Recreation Emphasis Area are within the research natural area.	N/A	390 acres of the Hebgen Winter Recreation Emphasis Area are within the Research natural area.
Palace Butte RNA (1280 Ac)	About 242 and 18 acres of the Hyalite Creek and Maid of the Mist Creek eligible Wild and Scenic River ("scenic" classification), respectively. Are within the research natural area. 1,280 acres of the 2001 Hyalite – Porcupine – Buffalo Horn Inventoried Roadless Area are within the research natural area.	About 242 and 18 acres of the Hyalite Creek and Maid of the Mist Creek eligible Wild and Scenic River ("scenic" classification), respectively. Are within the research natural area. 1,280 acres of the 2001 Hyalite – Porcupine – Buffalo Horn Inventoried Roadless Area are within the research natural area. About 1,272 acres of the Hyalite Recreation Emphasis Area are within the research natural area.	About 242 and 18 acres of the Hyalite Creek and Maid of the Mist Creek eligible Wild and Scenic River ("scenic" classification), respectively. Are within the research natural area. 1280 acres of the 2001 Hyalite – Porcupine – Buffalo Horn Inventoried Roadless Area are within the research natural area. 1,280 acres of the Hyalite Watershed Recreation Emphasis Area are within the research natural area.	1280 acres of the Gallatin Recommended Wilderness Area would be within the research natural area if the Hyalite – Porcupine – Buffalo Horn Wilderness Study Area designation is removed in the future. A portion of the research natural area is within Hyalite Creek and Maid of the Mist Creek eligible Wild and Scenic River with a classification of "scenic", about 242 and 18 acres, respectively. 1,280 acres of the 2001 Hyalite – Porcupine – Buffalo Horn Inventoried Roadless Area are within the research natural area.	1280 acres of the Gallatin Recommended Wilderness Area would be within the research natural area if the Hyalite – Porcupine – Buffalo Horn Wilderness Study Area designation is removed in the future. A portion of the research natural area overlap with Hyalite Creek and Maid of the Mist Creek eligible Wild and Scenic River with a classification of "scenic", about 242 and 18 acres, respectively. 1,280 acres of the 2001 Hyalite – Porcupine – Buffalo Horn Inventoried Roadless Area are within the research natural area.
Wheeler Ridge RNA (640 Ac)	N/A	N/A	N/A	640 acres of with the Gallatin Recommended Wilderness Area are within the Research natural area.	N/A
Line Creek Plateau RNA (CGNF 19,369 Ac) (SNF 3053 Ac)	About 18,089 acres of the 2001 Line Creek Plateau Inventoried Roadless Area are within the CGNF portion of the research natural area.	About 18,089 acres of the 2001 Line Creek Plateau Inventoried Roadless Area are within the CGNF portion of the research natural area.	About 18,089 acres of the 2001 Line Creek Plateau Inventoried Roadless Area are within the CGNF portion of the research natural area.	About 18,089 acres of the 2001 Line Creek Plateau Inventoried Roadless Area are within the CGNF portion of the research natural area.	About 18,089 acres of the 2001 Line Creek Plateau Inventoried Roadless Area are within the CGNF portion of the research natural area.

Name	Current Plans	Alternative B	Alternative C	Alternative D	Alternative E
Lost Water Canyon RNA (3645 Ac)	3645 acres of the 2001 Lost Water Canyon Inventoried Roadless Area are within the research natural area.	3,645 acres of the 2001 Lost Water Canyon Inventoried Roadless Area are within the research natural area. 3,645 acres of the Lost Water Canyon Creek eligible Wild and Scenic River ("wild" classification) are within the research natural area.	3,645 acres of the 2001 Lost Water Canyon Inventoried Roadless Area are within the research natural area. 3645 acres of the Lost Water Canyon Creek eligible Wild and Scenic River ("wild" classification) are within the research natural area.	3,645 acres of the 2001 Lost Water Canyon Inventoried Roadless Area are within the research natural area. 3645 acres of the Lost Water Canyon Creek eligible Wild and Scenic River ("wild" classification) are within the research natural area.	3,645 acres of the 2001 Lost Water Canyon Inventoried Roadless Area are within the research natural area. 3645 acres of the Lost Water Canyon Creek eligible Wild and Scenic River ("wild" classification) are within the research natural area.
Poker Jim RNA (363 Ac)	363 acres of the 2001 Tongue River Breaks Inventoried Roadless Area are within the research natural area.	The RNA falls within the 2001 Tongue River Breaks inventoried roadless area.	The RNA falls within the 2001 Tongue River Breaks inventoried roadless area.	The RNA falls within the 2001 Tongue River Breaks inventoried roadless area.	The RNA falls within the 2001 Tongue River Breaks inventoried roadless area.

Custer Gallatin National Forest is "CGNF" in this table

Effects from Minerals Management

Per Forest Service manual 4063, proposals to offer Federal mineral, oil, and gas leases would be evaluated by the Regional Forester, with concurrence of the station director, using standards set forth in Forest Service manual 2820. The recommendation proposals are forwarded by the Regional Forester to the Forest Service Chief for the final decision. Mineral management within restrictions of policy and plan components for all revised plan alternatives would have minimal impact.

Effects from Permitted Livestock Grazing Management

The revised forest plan under the current plans and revised plan alternatives allows for incidental grazing to occur where consistent with site establishment records and plans. However, generally, site records would preclude this; therefore, grazing would have minimal impact.

Effects from Access and Recreation Management

Non-motorized and motorized recreational use revised plan alternative plan components do not differ from decisions made in the 1986 and 1987 forest plans, as amended.

Non-motorized travel and recreational use is allowed within research natural areas. However, Line Creek Plateau Research Natural Area specifically limits mountain biking (to use to only system trails); prohibits hitching, tethering, picketing horses, or other recreational livestock within 200 feet of a stream or other free-flowing water; and prohibits camping (including building a fire, other than fires confined to liquid fuel stoves) within 200 feet of any lakeshore or 100 feet of any live stream or free-flowing water. Non-motorized recreational use is expected to cause minimal to no impact to the values associated with the research natural areas.

Motorized over-snow vehicle use is suitable on specific routes and areas as identified on the motorized over-snow vehicle use maps for the Custer Gallatin and in the Line Creek Plateau Research Natural Area Decision Order. Line Creek Plateau Research Natural Area specifically restricts motorized vehicle use to only Highway 212 and to Line Creek Trailhead (Road 2124) parking area and restricts snowmobile use to only the 250 centerline easement of Highway 212. Recreational uses are not expected to impact the values associated with these areas under any of the alternatives.

Summer Recreation Opportunity Spectrum (ROS)

Managing for primitive or semi-primitive non-motorized recreation opportunities would not result in substantial impacts to the natural vegetation and natural processes in these areas. Additionally, managing for semi-primitive motorized or roaded natural opportunities would not result in substantial impacts to the natural vegetation and natural processes in these areas because activities (in these recreational opportunity spectrum settings) are required to meet research natural area plan components. Acreages of motorized recreational opportunity spectrum classes in research natural areas are due to the influence of roads near the boundary of research natural areas and do not mean that motorized routes can be built in land designations such as research natural areas where they are not allowed. The following table displays overlapping summer recreational opportunity spectrum classifications with the established research natural areas where recreation use is not encouraged.

Winter Recreation Opportunity Spectrum Settings

Managing for primitive or semi-primitive non-motorized recreation opportunities would not result in substantial impacts to the natural vegetation and natural processes in these areas. Additionally, managing for semi-primitive motorized or roaded natural opportunities would not result in substantial impacts to the natural vegetation and natural processes in these areas because activities (in these recreation opportunity spectrum settings) are required to meet research natural area plan components. Acreages of motorized recreation opportunity spectrum classes in research natural areas are due to the influence of roads near the boundary of research natural areas and do not mean that that motorized routes can be built in land designations such as research natural areas where they are not allowed. The following table displays overlapping winter recreation opportunity spectrum classifications with the established research natural areas where recreation use is not encouraged.

Table 175 and table 176 show summer and winter recreation opportunity spectrum impacts by alternative.

Effects from Scenery Management

The scenery direction under the all alternatives do not prohibit on-the-ground actions, but may influence the design or the location of on-the-ground projects that would be visible from any of the listed critical viewing platforms. Design features or mitigations may be required to meet or exceed the assigned scenic integrity objective, which describes the lowest threshold of visual dominance and deviation from the surrounding scenic section.

To meet research natural area designation direction to facilitate research, revised plan alternative plan components allows a deviation in areas of very high scenic integrity objective (where research natural areas overlap with designated or recommended wilderness) and allows minor infrastructure or landscape alterations for research activities. This direction is not expected to impact the desired conditions for the research natural areas.

Research natural areas located within areas assigned a scenic integrity objective other than very high, research-related infrastructure or landscape alterations should meet the assigned scenic integrity objective as viewed from the listed critical viewing platforms. This direction is not expected to impact the desired conditions for the research natural areas.

Effects from Road Access and Infrastructure

All revised plan alternatives are similar in terms of plan components for road access and infrastructure. New road and trail construction, or other infrastructure and facilities, would not generally occur in research natural areas under any alternative, because Forest Service manual 4063 prohibits new roads, trails, fences, or signs on an established RNAs unless they contribute to the objectives or protection of the area.

Table 175. Summer recreation opportunity spectrum (ROS) setting overlap with acres of research natural areas (RNA)

Research Natural Area	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Line Creek Plateau RNA	About 1275, 60, 16,713, and 1,321 acres of roaded natural, semi-primitive motorized, semi-primitive nonmotorized, and primitive ROS settings, respectively.	About 875, 60, 17,113, and 1,321 acres of roaded natural, semi-primitive motorized, semi-primitive nonmotorized, and primitive summer ROS settings, respectively.	About 875, 60, 16713, and 1,721 acres of roaded natural, semi-primitive motorized, semi-primitive nonmotorized, and primitive summer ROS settings, respectively.	About 875, 60, 40, and 18,394 acres of roaded natural, semi-primitive motorized, semi-primitive nonmotorized, and primitive summer ROS settings, respectively.	About 1,275, 60, 16,713, and 1,321 acres of roaded natural, semi-primitive motorized, semi-primitive nonmotorized, and primitive ROS settings, respectively.
Lost Water Canyon RNA	285 and 3,360 acres of semi-primitive motorized and semi-primitive nonmotorized summer ROS settings, respectively.	285 and 3,360 acres of semi-primitive motorized and semi-primitive nonmotorized summer ROS settings, respectively.	3,645 acres of primitive summer ROS settings	3,645 acres of primitive summer ROS settings	285 and 3,360 acres of semi-primitive motorized and semi-primitive nonmotorized summer ROS settings, respectively.
East Fork Mill Creek RNA	882 acres of primitive summer ROS settings	882 acres of primitive summer ROS settings	882 acres of primitive summer ROS settings	882 acres of primitive summer ROS settings	882 acres of primitive summer ROS settings
Palace Butte RNA	380 and 900 acres of semi-primitive motorized and semi-primitive nonmotorized summer ROS settings, respectively.	380 and 900 acres of semi-primitive motorized and semi-primitive nonmotorized summer ROS settings, respectively.	380 and 900 acres of semi-primitive motorized and semi-primitive nonmotorized summer ROS settings, respectively.	1,280 Ac Primitive summer and winter ROS	380 and 900 acres of semi-primitive motorized and semi-primitive nonmotorized summer ROS settings, respectively.
Passage Creek RNA	720 and 392 acres of primitive and semi-primitive nonmotorized summer ROS settings, respectively.	720 and 392 acres of primitive and semi-primitive nonmotorized summer ROS settings, respectively.	720 and 392 acres of primitive and semi-primitive nonmotorized summer ROS settings, respectively.	720 and 392 acres of primitive and semi-primitive nonmotorized summer ROS settings, respectively.	720 and 392 acres of primitive and semi-primitive nonmotorized summer ROS settings, respectively.
Poker Jim RNA	363 acres of settings of semi-primitive nonmotorized summer ROS settings.	363 acres of settings of semi-primitive nonmotorized summer ROS settings.	363 acres of settings of semi-primitive nonmotorized summer ROS settings.	363 acres of settings of -primitive nonmotorized summer ROS settings.	363 acres of settings of semi-primitive nonmotorized summer ROS settings.
Sliding Mountain RNA	1,459 acres of primitive summer ROS settings	1,459 acres of primitive summer ROS settings	1,459 acres of primitive summer ROS settings	1,459 acres of primitive summer ROS settings	1,459 acres of primitive summer ROS settings
Wheeler Ridge RNA	66, 296 and 278 acres of roaded natural, semi-primitive motorized and semi-primitive nonmotorized summer ROS settings, respectively.	66, 296 and 278 acres of roaded natural, semi-primitive motorized and semi-primitive nonmotorized summer ROS settings, respectively.	66,296 and 278 acres of roaded natural, semi-primitive motorized and semi-primitive nonmotorized summer ROS settings, respectively.	640 acres of primitive summer ROS settings	66,296 and 278 acres of roaded natural, semi-primitive motorized and semi-primitive nonmotorized summer ROS settings, respectively.

Table 176. Winter recreation opportunity spectrum (ROS) setting overlap with acres of research natural areas (RNA)

RNA	Alt. A	Alt. B	Alt. C	Alt. D	Alt. E
East Fork Mill Creek RNA	882 acres of primitive winter ROS settings	882 acres of primitive winter ROS settings	882 acres of primitive winter ROS settings	882 acres of primitive winter ROS settings	882 acres of primitive winter ROS settings
Line Creek Plateau RNA	1,275, 16,773 and 1,321 acres of semi-primitive motorized, semi-primitive non-motorized and primitive winter ROS settings, respectively.	875, 17,173 and 1,321 acres of semi-primitive motorized, semi-primitive non-motorized and primitive winter ROS settings, respectively.	875, 16,773 and 1,721 acres of semi-primitive motorized, semi-primitive non-motorized and primitive winter ROS settings, respectively.	875, 100 and 18,394 acres of semi-primitive motorized, semi-primitive non-motorized and Primitive Winter ROS settings, respectively	1,275, 16,773 and 1,321 acres of semi-primitive motorized, semi-primitive non-motorized and primitive winter ROS settings, respectively.
Lost Water Canyon RNA	285 and 3,360 acres of semi-primitive motorized and semi-primitive non-motorized Winter ROS settings, respectively	285 and 3,360 acres of semi-primitive motorized and semi-primitive non-motorized Winter ROS settings, respectively	3,645 acres of primitive winter ROS settings	3645 acres of primitive winter ROS settings	285 and 3,360 acres of semi-primitive motorized and semi-primitive non-motorized Winter ROS settings, respectively
Palace Butte RNA	1,280 acres of semi-primitive non-motorized winter ROS settings	1,280 acres of semi-primitive non-motorized winter ROS settings	1,280 acres of semi-primitive non-motorized winter ROS settings	640 acres of primitive winter ROS settings	1280 acres of semi-primitive non-motorized winter ROS settings
Passage Creek RNA	720 and 392 acres of primitive and semi-primitive non-motorized winter ROS settings, respectively.	720 and 392 acres of primitive and semi-primitive non-motorized winter ROS settings, respectively.	720 and 392 acres of primitive and semi-primitive non-motorized winter ROS settings, respectively.	720 and 392 acres of primitive and semi-primitive non-motorized winter ROS settings, respectively.	720 and 392 acres of primitive and semi-primitive non-motorized winter ROS settings, respectively.
Poker Jim RNA	363 acres of semi-primitive non-motorized winter ROS settings	363 acres of semi-primitive non-motorized winter ROS settings	363 acres of semi-primitive non-motorized winter ROS settings	363 acres of primitive non-motorized winter ROS settings	363 acres of semi-primitive non-motorized winter ROS settings
Sliding Mountain RNA	1,459 acres of primitive winter ROS settings	1,459 acres of primitive winter ROS settings	1,459 acres of primitive winter ROS settings	1,459 acres of primitive winter ROS settings	1,459 acres of primitive winter ROS settings
Wheeler Ridge RNA	490 and 150 acres of Semi-primitive motorized and semi-primitive non-motorized Winter ROS settings, respectively.	490 and 150 acres of Semi-primitive motorized and semi-primitive non-motorized Winter ROS settings, respectively.	490 and 150 acres of Semi-primitive motorized and semi-primitive non-motorized Winter ROS settings, respectively.	640 acres of primitive Winter ROS settings	490 and 150 acres of Semi-primitive motorized and semi-primitive non-motorized Winter ROS settings, respectively.

Cumulative Effects

Under all alternatives, the network of research natural areas would contribute to the understanding of key ecosystems and plant communities by being part of the broader array of sites that are designated across other national forests in the region. This network would continue to contribute to the conservation of biological diversity, and provide for research and educational opportunities in the Custer Gallatin. Similar designations are not known to occur on lands of private ownership, nor on state lands in the area, increasing the importance of maintaining them on National Forest System lands.

The existing vegetation conditions within the designated areas reflect the contributions of past management actions and ecological processes. Management activities are very limited within research natural areas; restricted to management activities needed to maintain the features for which the research natural area established. Management activities would generally continue to take place outside of the existing research natural areas, and it is unlikely that these activities would have an effect.

Conclusion

In all alternatives, plan components would be sufficient to maintain the characteristics of the designated research natural areas. Overlapping land allocations would be compatible with research natural area activities that overlap with wilderness areas, wilderness study areas, and recommended wilderness areas would be compatible. All alternatives provide for a network of research natural areas across the Custer Gallatin, by including the existing designations of ten research natural areas. All alternatives are consistent with the site establishment record and standards in Forest Service manual 4063.

3.21.8 Special Areas

Affected Environment (Existing Condition)

The Custer Gallatin National Forest has two designated special areas, which total approximately 3,773 acres. These special areas are designated for research and education of botanical and paleontological resources. There is one botanical “candidate” special area in the Pryor Mountains that warrants further evaluation prior to determining if it should be a proposed or established special area by the Regional Forester. There are currently no proposed special areas, though other areas may be identified in the future. Designated special areas are those that have been formally established by a decision signed by the Regional Forester, after being vetted through the Custer Gallatin and forest planning, during revision or by amendment. Proposed special areas have been vetted through the national forest via forest planning (either in revision or by amendment), but they have not been established by a Regional Forester decision. Candidate special areas have not been fully vetted by the Custer Gallatin and Regional Forester and have not been included in a forest plan as proposed or established.

Each special area is managed as an integral part of the National Forest System with emphasis on its unique values. Other values or resources in the area are managed to a level compatible with the area's primary values and overall national forest management objectives. The existing conditions and effects by alternative for these designated area categories are discussed in this section.

The purpose of special areas are to provide long-term protection to an area for scientific research and interpretation opportunities.

Purposes for the establishment of special areas include: area protection and, where appropriate, to foster public use and enjoyment of areas with scenic, historical, geological, botanical, zoological, paleontological, or other special characteristics. The objectives also include classifying areas that possess unusual recreation and scientific values so that these special values are available for public study, use, or enjoyment.

The two established special areas on the Custer Gallatin are designated for the purpose of conserving biodiversity, conducting research and monitoring, and fostering education. A candidate botanical special area has been identified in the Pryor Mountains. Since not fully vetted by the Custer Gallatin or region as a proposed or designated special area, related plan components for conserving the botanical values for the Pryor Mountains are addressed in the Pryor Mountains geographic area section.

Table 177 lists established and candidate special areas on the forest, with a brief description of each following the table. Refer to Appendix A for maps displaying the locations of the established special areas.

Table 177. Established and candidate special areas, establishment dates and acres

Name	Geographic Area	Status	Designated Acres
Black Sand Spring Botanical Special Area	Madison, Henrys Lake, Gallatin Mountains	Established	407
Bangtail Botanical and Paleontological Special Area	Bridger, Bangtails, Crazy Mountains	Established	3,366
Pryor Mountain Candidate Botanical Special Area	Pryor Mountains	Candidate	Undetermined
Total Acres – Designated Special Areas			3,773

Bangtail Botanical and Paleontological Special Area

The 3,366-acre Bangtail Botanical and Paleontological Special Area was established in 2007 and is located on the Bozeman Ranger District. This special area is characterized by mountain meadow and subalpine ecosystems and important paleontological resources. The area is unique as it represents landscapes that extend from central Wyoming to northern Montana, and is comparable to bunchgrass ecosystems of Asia and the Andes Mountains. It is also unique because it is accessible and has supported thirty years of research, thus providing valuable baseline data for present and future studies. Elevation ranges from about 7,000 to 8,000 feet.

Black Sands Spring Botanical Special Area

The 407-acre Black Sands Spring Botanical Special Area was established in 1997 and is located on the Hebgen Lake Ranger District. This special area is characterized by spring creek riparian vegetation. This area is adjacent to the Madison Fork Ranch Conservation Easement (The Nature Conservancy) and provides added value to the overall conservation of the ecological integrity around the south fork of the Madison River. Various shrub and herbaceous species occupy riparian sites such as wet meadows. Elevation ranges from about 6,500 to 6,600 feet.

Pryor Mountains Candidate Botanical Special Area

The Pryor Mountains candidate botanical Special Area is located on the Beartooth Ranger District. The candidate special area (undetermined location and acreage) has not been fully vetted by the Custer

Gallatin or Regional Forester and is not included as a proposed or established special area under the revised plan alternatives. This candidate special area is characterized by a unique and diverse assemblage of botanical resources and plant associations within a relatively small area. Because of a unique convergence of three floristic provinces (Northern Great Basin, Middle Rocky Mountains, and Northern Great Plains), the Pryor Mountains are considered a "botanical hotspot," rich in species and community diversity. Many rare endemic and peripheral plant species in the Pryor Mountains are associated with the Madison limestone geology of the area. This candidate special area provides value to the overall conservation of the ecological integrity of the Pryor Mountains. Elevation ranges from 4,400 to 8,800 feet.

Environmental Consequences

Current Plans

Management Direction under the Current Plans

Management direction for special areas is found under management area 21 of the 1986 Gallatin Forest Plan. The management goal for Bangtail Special Area to protect unique botanical and paleontological values for study and public enjoyment. The management goal for Black Sand Springs Special Area is to protect unique botanical values for study and public enjoyment.

In the current plans, wheeled motorized travel on designated roads and trails and oversnow travel is allowable in the Bangtail Special Area. Wheeled motorized travel on designated roads and trails is allowable in the Black Sand Springs Special Area. A portion of the Black Sand Springs Special Area is open to oversnow travel, and a portion is not open.

Effects of the Current Plans

The current Gallatin Forest Plan limits most management activities from occurring in these areas, with the exception of prescribed fire and invasive plant control. Permitted grazing is allowed within the Bangtail Special Area, while the Black Sands Spring Special Area is not suitable for permitted grazing. These special areas are not suitable for timber production, but vegetation management activities are allowed. Within the restrictions of plan components and policy direction, the expected effects are minimal.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

Revised plan alternatives have the same plan components for designated special areas. New improvements would only be allowed when they are necessary to maintain, restore, or enhance the values for which the special area was designated. Vegetation management activities such as prescribed fire, forest vegetation management, and invasive species treatment would be limited to actions that perpetuate the natural diversity of plant communities.

Wheeled motorized travel on designated roads and trails and oversnow travel is allowable in the Bangtail Special Area. The revised plan alternatives restrict summer and winter motorized vehicle and over snow use to the existing road in the Black Sand Springs Special Area.

To help maintain or restore resilient ecosystems for the biological diversity and conservation values of the Pryor Mountains and not to foreclose options for future special area designation, plan components in the Pryor Mountain geographic area section would place an emphasis on weed prevention, detection, and control and require management activities to protect locations of regional endemic and peripheral plant occurrences.

Effects of the Revised Plan Alternatives

Management direction for the designated special areas are similar to the existing plan, although the revised plan alternatives provide more specific restrictions on new management activities in these areas. There are no notable differences in potential effects, which are to protect the values associated with the special area.

The revised plan alternatives have a beneficial effect on the special areas by bringing greater recognition of the role these areas plays in education and research and retaining opportunities for management of the forests in these areas.

The Pryor Mountain geographic area plan components under all revised plan alternatives would not foreclose opportunity for future potential designation of as a botanical special area. Plan components for all revised plan alternatives emphasize control of aggressive invasive plants and other conservation guidelines. Within the restrictions of plan components and policy direction, the expected effects would be minimal. In addition, alternatives vary regarding protective land allocations such as recommended wilderness areas or backcountry areas, and may offer further protections for botanical features.

Consequences to Special Areas from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Vegetation and Timber Management

Forested habitats occur in the Bangtail Special Area and are negligible in the Black Sands Special Area. It is expected that vegetation management activities could have role in affecting the condition of forested habitats even though they are not considered suitable for timber production. Under all alternatives, special areas are not suitable for timber production, therefore timber management for timber production should have no effect. In all alternatives timber harvest, firewood gathering, and other vegetation management activities (such as prescribed fire) may only be allowed to maintain or achieve the desired conditions and purpose for the special area, such as restoration, study, or research. Vegetation management could maintain or improve forested conditions for resilient ecosystems compatible with the values for which the special areas were established. Timber harvest and vegetation management activities that occur on the broader landscape could influence the type and severity of wildfire that enters special areas.

Control of invasive weeds in special areas would have a positive effect through the control of invasive weeds or prevention of their spread and would not result in any change to designations or preclude designation of the Pryor Mountain candidate botanical special area in the future.

Effects from Fire and Fuels Management

In all alternatives, desired conditions for special areas are lands where natural processes (including fire) can function naturally. Management of unplanned ignitions (wildfire) in or near special areas would be guided by forest plan components as well as direction provided in each individual special area’s decision record, the Forest Service manual, and consultation with scientists and other partners.

If the values associated with the special area are at risk of degradation or loss due to fire, fire management strategies would likely include measures aimed at protecting those values, if possible. On the other hand, fire as a natural process may be desired and allowed to occur within a special area to perpetuate the natural functioning of the ecosystem. In either case, the effects from fire and fire management strategies are expected to have a positive effect on the condition and perpetuation of the ecological and recreational values.

Effects from Watershed, Soil, Riparian, and Aquatic Management

The majority of the Bangtail Special Area overlaps with the Canyon Creek, Bangtail Creek, and Willow Creek Conservation Watershed Networks under all revised plan alternatives. The Pryor Mountains candidate botanical special area overlaps with the Lost Water Canyon Conservation Watershed Network under all revised plan alternatives. Activities related to Conservation Watershed Networks must meet applicable standards and guidelines for research natural areas. Within the restrictions of plan components and policy direction, the expected effects are minimal.

The revised plan alternatives provide more detailed guidance than the current plans for protection of watersheds, riparian areas, and aquatic habitats. The revised plan alternatives include the adoption of riparian management zones, which are greater in size from the riparian zones currently identified for streams east of the Continental Divide. Revised plan alternative plan components and objectives for aquatic ecosystems would complement the overall management of the designated and candidate special areas by promoting the ecological integrity of watersheds, riparian areas, and aquatic habitats.

Activities related to watershed, soil, riparian, or aquatic habitat would generally not occur in special areas unless to help restore ecosystems supporting values for which the special areas were designated, and there would be little to no effect related to the management of these resources.

Effects of Land Allocations

Hebgen Lake Winter Recreation Emphasis Area overlaps with Black Sand Springs Botanical Special Area under alternatives B, C, and E. Because general recreation is managed in such a way that ecological values of the special area are maintained and motorized vehicle or snowmobile use is to be restricted to the existing road (off-road motorized travel is not allowed), the overlap is projected to have little to no effect to Black Sand Spring Botanical Special Area. There would be no overlapping land allocations with the Bangtail Special Area in any alternative.

Effects from Access, Infrastructure, and Recreation Management

Nonmotorized travel and recreational use is allowed within special areas and limited motorized travel is permitted to meet administrative, research, and educational objectives. This use is expected to cause minimal to no impact to the values associated with the special area. Summer motorized travel is allowed on designated routes within special areas. Motorized over-snow vehicle use is suitable on specific routes and areas as identified on the motorized over-snow vehicle use maps for the Custer Gallatin; and all revised plan alternatives specifically limit summer and winter motorized vehicle and over snow use to the existing road in the Black Sand Springs Special Area. These uses are not expected to impact the values associated with these areas under any of the alternatives.

Under all alternatives, the winter and summer recreation opportunity spectrum setting for Black Sands Spring Special Areas is roaded natural. Under all alternatives, the winter and summer recreation opportunity spectrum setting for Bangtail Special Areas is roaded natural on the north portion and semi-primitive motorized on the southern portion. These uses are compatible with special area management guidance, but may do less to protect the desired characteristic of the area than the primitive recreation opportunity spectrum setting.

A variety of summer and winter recreational opportunity spectrum settings vary by alternative in the Pryor Mountains. Areas of the Pryor Mountains that have summer or winter recreation opportunity spectrum settings of semi-primitive motorized, or roaded natural are compatible with general special areas management policy and guidance. However, less may be done to protect the desired characteristic of the area than the primitive or semi-primitive nonmotorized recreation opportunity spectrum settings.

All revised plan alternatives are similar in terms of plan components for road access and infrastructure. New road and trail construction, or other infrastructure and facilities, would not generally occur in special areas under any alternative. Forest Service manual 2370 prohibits new roads, trails, fences, or signs on an established special area unless they contribute to the objectives or protection of the area.

Effects from Scenery Management

The current plans would continue to incorporate the visual quality objectives prescribed for special areas are preservation or retention (comparable to a very high or high scenic integrity objectives) and would have negligible impact on special areas.

The forest plan scenic integrity objectives under the revised plan alternatives do not prohibit on-the-ground actions, but may influence the design or the location of on-the-ground projects that would be visible from any of the listed critical viewing platforms. Design features or mitigations may be required to meet or exceed the assigned scenic integrity objective, which describes the lowest threshold of visual dominance and deviation from the surrounding scenic character.

Under the revised plan alternatives, about half Black Sands Spring and Bangtail Special Areas are each assigned a scenic integrity objective of low and half classified as moderate. Landscape alterations should meet the assigned scenic integrity objective as viewed from the listed critical viewing platforms. There may be more management flexibility in the revised plan alternatives than the current plans because of lower scenery requirements. Those areas classified as low may allow more flexibility in the type of management actions that could benefit special area activities than those classified as moderate.

Effects from Permitted Livestock Grazing Management

The no action and revised plan alternatives allow for grazing in Bangtail Special Area, but grazing is not suitable in the Black Sands Spring Special Area. Grazing within restrictions of plan components for all revised plan alternatives would have minimal impact on the Bangtail Special Area.

In the revised plan alternatives, new allotment infrastructure should be located to minimize livestock impacts on regional endemic and peripheral plant occurrences that are susceptible to livestock impacts. This restriction would help ensure options for future special area designation in the Pryor Mountains.

Effects from Minerals Management

Special Areas are available for minerals activities. However, proposals to offer Federal mineral, oil, and gas leases would be evaluated by the Regional Forester, using standards set forth in Forest Service

Manual 2820. Mineral management within restrictions of policy and plan components for all revised plan alternatives would have minimal impact on special areas.

In the revised plan alternatives, removal of saleable mineral material would not be allowed within regional endemic and peripheral plant occurrences. Mineral exploration and development activities would be managed to minimize impacts to these plants in the Pryor Mountains. These restrictions would help ensure options for future special area designation in the Pryor Mountains.

Cumulative Effects

The existing vegetation conditions within the designated areas reflect the contributions of past management actions and ecological processes. Management activities will generally continue to take place outside of the existing special areas, and it is unlikely that these activities would have an effect on these areas.

Conclusion

In all alternatives, plan components and regulatory framework would be sufficient to maintain the characteristics of the designated special areas. Overlapping land allocations would be compatible with special areas. All alternatives provide plan components that conserve these areas for the values for which they were designated, by including the existing designations of special areas. Alternatives B through E would include the addition of one candidate botanical special area in the Pryor Mountains that would need further evaluation. Plan components for all alternatives are consistent with the area decision record and direction in Forest Service Manual 2370.

3.21.9 National Natural Landmarks

Affected Environment (Existing Condition)

The National Natural Landmarks Program was established in 1962 by administrative action and relied on authority provided in the Historic Sites Act of 1935. Three other laws subsequently referenced the program. The first national natural landmarks were designated by the secretary of the interior in 1964.

The National Natural Landmarks Program recognizes and encourages the conservation of sites that contain outstanding biological and geological resources. Sites are designated by the secretary of the interior for their condition, illustrative character, rarity, diversity, and value to science and education. The National Park Service administers the program and works cooperatively with landowners, managers, and partners to promote conservation and appreciation of our nation's natural heritage.

The goals of the National Natural Landmarks Program are to encourage the preservation of sites illustrating the geological and ecological character of the United States, to enhance the scientific and educational value of sites, strengthen public appreciation of natural history, and to foster a greater concern for the conservation of the nation's natural heritage.

Three national natural landmarks are located on the Custer Gallatin: Capital Rock and the Castles National Natural Landmarks on the Sioux District, and Middle Fork Canyon National Natural Landmark in the Bridger Mountains.

The Middle Fork Canyon National Natural Landmark, designated in 1977, includes 960 acres, of which only eighty acres is on National Forest. The national natural landmark illustrates rocks deformed by the

Earth's tectonic movement. It is an outstanding example of a canyon cut across the grain of the geologic structure by a superposed stream. Few places more clearly illustrate the effects of erosion and stream superposition.

The Capital Rock National Natural Landmark includes 244 acres and was designated in 1976 for uniqueness of geologic formation due to uplift and erosion within the surrounding prairie environment. The area is a remnant of the once continuous blanket of tertiary deposits that covered much of the Great Plains. Late Cretaceous, Paleocene, Oligocene, and Miocene (different geographic periods) are well displayed.

The Castles National Natural Landmark on the Sioux Ranger District includes 987 acres and was designated in 1976 for the area's uniqueness of geologic formation due to uplift and erosion within the surrounding prairie environment. Steep-walled, flat-topped buttes standing 200 to 400 feet above the surrounding prairie, the Castles contain exposed rock of Upper Cretaceous, Paleocene, Oligocene, and Miocene Ages. Cretaceous and Tertiary beds contain a variety of flora and fauna fossils. The boundary of the Castles National Natural Landmark was adjusted in 2017 to remove the portion of the landmark north of Highway 20.

Environmental Consequences

Current Plans

Management Direction under the Current Plans

No direction currently exists in the 1987 Gallatin Forest Plan, so management of the Middle Fork Canyon National Natural Landmark in the Bridger Mountains has relied on direction contained within enabling authority. The 1986 Custer Forest Plan provides direction to protect the unique geological and scenic features of the national natural landmarks and to provide a recreation opportunity. Coordination with the National Park Service on any proposed projects is part of the ongoing management within the landmarks.

Effects of the Current Plans

Coordination of management actions with the National Park Service as required by designation has been ongoing, including updating interpretative displays.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

Plan components are the same for all revised plan alternatives. The Custer Gallatin would coordinate with the National Park Service on new development and management activities. New energy and utility corridors would not be located in national natural landmarks and national natural landmarks would not be suitable for timber production. Timber harvest may be allowed for purposes such as fuels reduction, restoration or wildlife habitat enhancement.

Effects of the Revised Plan Alternatives

Plan components will protect the National Natural Landmarks in coordination with the National Park Service.

Consequences to National Natural Landmarks from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Vegetation and Timber Management

In all alternatives, National Natural Landmarks are not suitable for timber production. Under the current plans, trees may be cut to remove diseased material and to provide for public safety. The revised plan alternatives allow timber harvest in more circumstances, such as fuels reduction, restoration or wildlife habitat enhancement, which when coupled with vegetation components for ecological diversity, resilience, and sustainability, may enhance the resilience of National Natural Landmarks.

Effects from Fire and Fuels Management

Both natural and management-ignited fires could change the scenery surrounding the landmarks, including charred vegetation in the short term as well as re-growth in the longer term. The current plans fire suppression direction from the Custer Plan is to contain and control wildfires at the landmarks, while the Gallatin Plan considers multiple fire management strategies. To minimize resource damage, revised plan alternative fire and fuels plan components call for minimum impact suppression tactics in sensitive areas, which would reduce scenic impacts from the suppression effort itself. Exceptions may occur when a more direct attack is needed to protect life or adjacent property or mitigate risks to responders.

Effects from Watershed, Riparian, and Aquatic Management

The revised plan alternatives provide more detailed guidance than the current plans for protection of watersheds, riparian areas, and aquatic habitats. The revised plan alternatives include the adoption of riparian management zones, which are greater in size from the riparian zones currently identified for streams east of the Continental Divide. Revised plan alternative plan components which restore or maintain ecosystem functions would complement National Natural Landmarks.

Effects from Access and Recreation Management

National natural landmarks contribute unique geological and scenic features and offer a recreation opportunity. In all alternatives, plan components require new facility proposals to be coordinated with the National Park Service and do not alter the special features that allowed the designations.

Effects from Scenery Management

National natural landmarks contribute unique geological and scenic features. In all alternatives, the scenery of the landmarks is protected by the scenery plan components. In the current plans, the landmarks are assigned a visual quality objective of retention (equivalent to a high scenic integrity objective). In the revised plan alternatives, the landmarks are assigned a moderate scenic integrity objective which will ensure that management activities at the landmarks will be subordinate to the surrounding landscape.

Cumulative Effects

The Custer Gallatin National Natural Landmarks are among the ten National Natural Landmark sites within the state of Montana, and the thirteen National Natural Landmark sites located entirely or partially within the state of South Dakota. Sites are designated by the secretary of the interior, with landowner concurrence, and to-date, nearly 600 landmarks have received the National Natural Landmarks designation within the United States, American Samoa, Guam, Puerto Rico, and the U.S. Virgin Islands.

Under all alternatives, the three National Natural Landmark sites would contribute to the preservation of unique geology as an integral part of the areas. Management activities will generally be limited to those that enhance restoration of the area while permitting recreational use, which is focused on interpretation.

Conclusion

Forest plan components protect and enhance National Natural Landmarks by protecting unique geological and scenic features and by offering recreation opportunities.

3.21.10 Pryor Mountain Wild Horse Territory

Affected Environment (Existing Condition)

The Pryor Mountain Wild Horse Territory (about 4,396 acres) is the Custer Gallatin's portion of the overall multi-jurisdictional Pryor Mountain Wild Horse Range. This area is a refuge for the Pryor Mountain herd of free-roaming wild horses. The overall range has an area of approximately 41,500 acres and consists of Bureau of Land Management (BLM), National Forest System lands, Bighorn Canyon National Recreation Area (National Park Service) managed lands, and a small amount of private lands; with the BLM as the lead agency.

Wild horses are managed in accordance with the Wild Free Roaming Horses and Burros Act of 1971, as amended. For managing on the range, the act requires minimum feasible management (wild horses are only to be managed where "presently found" at the time of the passage of the Act (as per 1971)), ensuring a thriving natural ecological balance, and maintaining multiple use relationships. The act, as amended, requires that appropriate management levels be determined and removal of excess wild horses immediately until a thriving natural ecological balance and multiple use relationship exists. The goal in the long term is to of have healthy wild horses on healthy rangelands.

Pryor Mountain Wild Horse Range and the Herd

The Forest Service and Bureau of Land Management (BLM) manages, protects, and controls wild horses and burros under the authority of the 1971 Wild Free-Roaming Horses and Burros Act, as amended. This law authorizes the agencies to remove excess wild horses from the range to sustain the health and productivity of the public lands. The agencies also manage the nation's public lands for multiple uses, in accordance with the 1976 Federal Land Policy and Management Act. Wild horses are part of this multiple-use mandate. Locally, the BLM is the lead agency for the management of the Pryor Mountain Wild Horse Herd and rangelands. The BLM's management efforts are supported by the Forest Service under a Service First Agreement for the Forest Service Pryor Mountain Wild Horse Territory. The Pryor Mountain Wild Horse Territory is primarily administered for the protection and management of wild horses, ecological conditions, wildlife, watershed, recreation, cultural, and scenic values.

Various landownerships exist within the Pryor Mountain Wild Horse Range. Of the approximate 41,500-acre range, about 70 percent consists of Bureau of Land Management (BLM) lands, 21 percent are National Park Service lands, seven percent are National Forest System lands, and 2 percent are private lands under lease. The Pryor Mountain Wild Horse Range varies in elevation from 3,850 to 8,800 feet. Annual precipitation varies with elevation with six inches of precipitation in the lower elevations to upwards of 20 inches in the subalpine high elevation. The national forest portion of the Pryor Mountain Wild Horse Range is termed "wild horse territory." The territory ranges in elevation from about 6,000 feet at the middle elevations to about 8,800 feet. Many Pryor wild horses' primary bloodline descends from Spanish Barbs and exhibit primitive markings such as dorsal stripes, transverse stripes across the withers, and horizontal "zebra" stripes on the back of the forelegs.

The Lost Water Canyon recommended wilderness and research natural area is adjacent to the west of the Pryor Mountain Territory and features a deep canyon with limited access opportunities due to the steep walls. Bureau of Land Management's Burnt Timber Canyon, Pryor Mountain, Big Horn Tack-On Wilderness Study Areas, and Bighorn Canyon National Recreation Area are adjacent to the territory on the south and east sides. The Pryor Mountain Wild horse territory is not currently identified for recommended wilderness.

Appropriate Management Level

The Forest Service and Bureau of Land Management work to achieve the "appropriate management level" (AML) (the point at which wild horse herd populations are consistent with the land's capacity to support them). In the context of the multiple-use mission, the appropriate management level is the level at which wild horses can thrive in balance with other public land uses and resources, including vegetation and wildlife.

This type of rangeland management is different from management of wildlife, which are controlled by hunters and natural predators, or livestock, which are controlled by grazing permits. Because of Federal protection and a lack of natural predators, wild horse and burro herds can double in size about every four years.

The appropriate management level is a range of low to maximum levels that allows for population growth over a four to five year period. It was established based on several years of rangeland resource and population data. Those evaluations look at information relating to vegetation, soils, and climate.

The appropriate management level for the overall Pryor Mountain Wild Horse Range is 90 to 120 horses (excluding the current years foal crop) (U.S. Department of Interior et al. 2009, U.S. Department of the Interior 2016a). The population is managed using a combination of population control techniques including gathers, fertility control, natural means, or a combination of prescriptions. When the appropriate management level is exceeded, the excess animals are scheduled to be removed and prepared for adoption or sent to off-range pastures.

The currently available fertility control vaccine, known as porcine zona pellucida (PZP), is limited in the duration of its effectiveness—up to 22 months for a formulation that must be hand-injected into a wild horse. A second formulation of the vaccine can be deployed with ground-darting, but is effective for up to only one year. This formulation is a viable fertility-control option for the Pryor wild horse herd because the animals are accustomed to human proximity and the herd size and size of range is small enough to locate and track individual horses.

Limitations of the Territory Boundary

There have been some requests for range expansion onto other National Forest System lands to increase the appropriate management level to allow for an increase in the population. The Wild Free-Roaming Horses and Burros Act, enacted December 15, 1971, directs that wild horses can only be managed on areas of National Forest System and Bureau of Land Management (BLM) lands where they were known to exist in 1971, at the time of the passage of the act. For the Forest Service, these areas are known as "territories" and for BLM they are known as "herd areas." Under section 1339 "Limitation of Authority," the Wild and Free-Roaming Horses and Burros Act of 1971 states "nothing in this act shall be construed to authorize the secretary to relocate wild free-roaming horses or burros to areas of the public lands where they do not presently exist." Until a change in the law allows for expansion of the Pryor Mountain Wild Horse Range onto additional national forest or BLM lands that are outside of the existing territory and herd area, the agencies have a legal obligation to follow the law to the greatest extent possible.

Comprehensive agency inventories (Hall 1972), assessments, public involvement, and decisions (BLM/USFS/NPS 1972, BLM/USFS 1974) provided the basis for the Bureau of Land Management (BLM) herd area and Forest Service territory boundaries per the 1971 Act. Subsequent land use planning efforts in 1987 by the Forest Service, and 1984 and 2015 by the BLM validated the same areas as being a wild horse territory and herd management area, respectively. If opportunities for private land purchase or lease present themselves, the agencies would consider them, especially if they involve winter range. Winter range is recognized by both agencies as being the limiting factor for overall population size. The 2009 Herd Management Area and Territory Plan environmental assessment provides a detailed history about the wild horses in this area and how boundaries were delineated.

Herd Management Area and Territory Plan

The 2009 Herd Management Area and Territory Plan was developed to improve management practices that would lead to healthy wild horses and protect the range from deterioration. Decisions from the territory plan environmental assessment updated the appropriate management level, developed prescriptions for habitat limitations, identified opportunities for improvement, and emphasized stabilization of ecological conditions. It serves as the primary wild horse management plan for all ownerships of the Pryor Mountain Wild Horse Range. The objectives of the territory plan are to improve wild horse and habitat management consistent with the Bureau of Land Management resource management plan and Custer Forest Plan. The territory plan supersedes previously identified direction (for example the 1984 and 1992 plans).

The Bureau of Land Management (BLM), Forest Service, and National Park Service work cooperatively in the long-term management of the Pryor Mountain Wild Horse Range. Each agency has certain decision making authorities related to their respective roles and jurisdictions in the management of the range. This includes the Forest Service and BLMs' population management, habitat conditions, and monitoring, as well as each agencies' ability to manage development (such as fencing, water developments, prescribed fire and fuels reduction, vegetation management, and native seeding).

Territory Condition

Rangeland Condition: Historically, severe turn of the 20th century overgrazing occurred on the higher elevations of the range; resulting in reduced soil and vegetative productivity as indicated by historic records. The allotment was closed to grazing after 1961, due to the severe sheet erosion and recovery needs (mechanical terracing and seeding) in the long term for shallow subalpine rangeland. Historically, the mid-elevation area had limited to no water and was not part of a grazing allotment. The other portions of the wild horse range on Bureau of Land Management and National Park lands had similar historical use.

The Natural Resource Conservation Service conducted a rangeland health study in 2004. The study found that the wild horse territory on National Forest System lands to be approximately 45 percent similarity to reference conditions at the mid elevations and about 30 percent similarity to reference conditions in high elevations. This similarity index estimates the state of succession at a given site by measuring composition and comparing it to the composition of the historic climax plant community (Ricketts 2004). The Pryor Mountain Territory contains no riparian areas and has limited water; snowmelt catchment areas occur, with the main water source located on nearby Bureau of Land management and leased private lands.

Actions under the decisions for the 2009 Herd Management Area and Territory Plan and subsequent fertility control/gathers were designed to help stabilize ecological conditions. However, ecological condition on many portions of the Pryor Mountain Wild Horse Range would likely to only slowly improve due to changed site capability from past historic unmanaged grazing.

Invasives: Fewer than 5 acres of spotted knapweed occurs (sporadically along the Burnt Timber Road #2849) within the national forest portion of the range. Other exotics on adjacent lands, such as cheatgrass, halogeton, and mustards are generally distributed in the lower elevations of the Pryor Mountain Wild Horse Range. Forest Service and Bureau of Land Management field crews continue to monitor and treat noxious weeds along the length of the Burnt Timber Road #2849 and adjacent rangelands or any new infestations.

The Influence of Fire: Historic wildland fire occurrence has been documented in a fire history study (Sneed and Winterowd 2006) The study, while not extensive enough to develop a picture of wildland fire history over the entire Pryor Mountain range, gives insight into the historic role of fire in the range ecosystem. This study characterizes the high altitude subalpine fir habitat types as functioning within a normal range of variability exhibiting a low-frequency, high-severity fire regime. The Douglas-fir stands indicate a moderately frequent, mixed fire regime. Limber pine stands are characterized as having a frequent, low-intensity fire regime. Most surface fires after the mid-1950s were probably quickly and effectively suppressed. The middle to upper level of Douglas fir/limber pine forested areas have developed a closed canopy, ladder fuels, and dead and down material with interspersed bare rocky areas. Fire modeling and historical evidence indicates that wildland fires are of two types: slow spreading ground fire, and high-intensity fast moving crown fires.

At-Risk Plants: Wild horses have been identified as a potential threat to Shoshonea (Shoshonea pulvinata), a Forest Service at-risk plant species. Information on Shoshonea from a trend report (Heidel 2001) indicated there was not sufficient data or observations to support or refute impacts occurring from wild horses. No direct evidence of grazing was observed.

Wildlife: The primary big game species found in the Pryor Mountain Wild Horse Range are mule deer, Rocky Mountain bighorn sheep, elk, and black bear. Mule deer are the most abundant and most widely distributed big game and rely on the sagebrush in the southern foothills during the winter. The bighorn sheep estimated populations are from between 100 to 160, with the bulk of the distribution within the Bighorn Canyon National Recreation Area. Elk do not use the area on a regular basis. Black bear are abundant in the north-central portions of the range where terrain is rugged and forested. Additional wildlife observations include mountain lions, upland game birds (including blue grouse), and a diverse bat population.

Recreational Use: Visitor logs maintained at Penn’s Cabin, located on the top of East Pryor Mountain, indicate an increase in visitor use both foreign and domestic. An independent 2003 survey of approximately 277 people indicated the Pryor Mountain Wild Horse Range has become a destination for local, national, and international visitors. Recreation use has been monitored and documented by the Bureau of Land Management from 2003 to the present. Since 2003, use has been steady or increasing (U.S. Department of Interior et al. 2008). The majority of the national forest portion of the range is accessible by four-wheel drive vehicles.

Recreation opportunities are primarily wild horse viewing during the warmer months of the year, especially during foaling season. Other opportunities include, but are not limited to hunting (bear, deer, and small game), hiking, and snowmobiling. Motorized use is limited to designated roads. The area is largely managed for dispersed recreation. Hiking opportunities in the Pryor Mountains are excellent, however, there are no maintained trails for hiking or off-highway vehicle use. Other uses include camping, horseback riding, photography, sightseeing, wildlife viewing, as well as large caves for exploring.

Demands for recreational opportunities and visitation within the Pryor Mountain range continue to increase. People are visiting the Pryor Mountain Wild Horse Range for wild horse viewing opportunities and to enjoy other recreational opportunities. Motorized use is continually increasing, along with camping, hunting (especially for bear), hiking, sight-seeing, amateur botany, and the experience of visiting open country.

Heritage Resources: The area contain a rich prehistoric and historic archaeological record including, but not limited to: quarries, rock art, rock shelters and caves, vision quest sites, lithic scatters, rock cairns and rock alignments, tepee rings, drive sites, wooden structure habitation, occupation sites, hunting related sites, wooden structure habitations (cabins), historic trails, and horse traps. Contemporary traditional cultural primary use sites, such as the Dryhead Overlook and Sykes Ridge, are found throughout the area. These areas have been used for generations by Crow Tribal members for traditional uses, ceremonies, and vision quest sites. Wild horses have potential to impact artifacts and increased visitation to view wild horses may also increase the potential for vandalism of these resources, which could interfere with tribal members’ contemporary traditional use.

Climate: Climate trends may have the potential to affect grazing capacity in both the short and long term. Changes in forage production may result from predicted shifts in precipitation patterns and increased temperatures.

Uncertainty about climate projections are much greater at the local and regional scales. Ecological response to climate related changes are difficult to model accurately at local scales. Though there is uncertainty based on modeling, it does not imply a complete lack of understanding regarding climate change and grazing lands. Planning analyses that incorporate modeling with uncertainty, and strategies in the short and long term that focus on enhancing ecosystem resistance and resilience will help manage the range. The Forest Service and Bureau of Land Management can also take actions to help ecosystems and resources move in synchrony with the ongoing changes in climate and the environment. Flexibility to address the inherent uncertainty about local effects of climate change could be achieved through enhancing the resiliency of rangelands. Efforts to address existing stressors would address current management needs, and potentially reduce the future interactions of these stressors with climate change (U.S. Department of Agriculture 2010).

The future bioclimatic setting within the wild horse territory is uncertain due to the ecosystem sensitivity to grazing pressure and the threshold for degradation changes within the bioclimatic setting, (resulting in lower sustainability in very dry and very humid ecosystems) (Asner et al. 2004). It is likely that as future average temperatures increase, snow pack would be reduced and snow melt, run-off, and peak flows would occur earlier in the year (USDA Climate Change Science Program, 2010). In addition, with increased atmospheric carbon, primary production is expected to increase particularly on semi-arid rangelands (Derner et al. 2005).

Environmental Consequences

Effects Common to All Alternatives

Managing wild horse habitat through direction by law, policy, and plan components would have a long-term positive impact on erosion reduction and water holding capacity of soils resulting in healthier plant communities and forge availability. Reduction in herd size or maintaining appropriate management level (AML) to meet Forest Plan standards and guidelines would impact individual animals requiring removal, gather operations or other population controls (for example, fertility and demographics).

Current Plans

Management Direction under the Current Plans

The 1986 Custer Forest Plan outlined management area direction for the Pryor Mountain Wild Horse Territory and reaffirmed the Bureau of Land Management (BLM) as the lead administrating agency (forest plan management area Q, p. 89, forest plan FEIS, pp. xi, 125, and 338; forest plan appendix C, pp. 194 and 196; forest plan record of decision, pp. 21 and 31). The current Herd Management Area Plan was developed jointly by the BLM, Forest Service, and Park Service. In addition to the forest plan, this document guides the management of public lands within the Pryor Mountain Wild Horse Range.

The 1986 Custer Forest Plan goal for the wild horse territory (management area Q) is to “provide for improved habitat conditions, including range and watershed, and for a healthy viable wild horse population.” Management area Q directs that the Forest Service will cooperate with the Bureau of Land Management (BLM) on the following: monitoring needs, that livestock will not be permitted, wildlife habitat will be maintained or enhanced in a manner that is compatible with wild horses and overall habitat conditions, prescribed fire may be used to enhance rangeland conditions for wild horses, new range improvements can be constructed (provided they do not attract horses into the Forest Service Lost Water Canyon recommended wilderness), and the two study enclosures and the Tillett Ridge horse trap would be retained. In addition, it is Forest Service policy (Forest Service Manual 2260.3) to confine wild free-roaming horses to managed horse territories as established pursuant to the 1971 act, to the extent possible.

Effects of the Current Plans

The Bureau of Land Management (BLM), Forest Service, and National Park Service will continue to work cooperatively in the long-term management of the Pryor Mountain Wild Horse Range. Each agency will retain their own management and decision making authorities related to their respective roles and jurisdictions in the management of the range.

As lead agency, the BLM, in consultation with the Forest Service, will continue to manage wild horses within a population range of the established appropriate management level, while maintaining genetic diversity, age structure, and sex ratios.

The current appropriate management level for the overall Pryor Mountain Wild Horse Range is 90 to 120 horses (excluding the current years foal crop) (BLM/FS/NPS 2009 and Sparks, et al. 2016). Since wild horse herds can double in size about every four years the population will continue to be managed using a combination of population control techniques including gathers, fertility control, natural means or a combination of prescriptions. When the appropriate management level is exceeded, the excess animals are to be removed and then prepared for adoption or sent to off-range long term holding pastures.

Permitted livestock grazing has not occurred in the territory since the early 1960s and it is not suitable in the wild horse territory.

Increased visitation to the Pryor Mountain Wild Horse Range is anticipated along with increased marketing to view wild horses. Commercial activity requests are anticipated to increase. With increased visitation, the potential for vandalism of cultural resources and interfere with tribal members' contemporary traditional use of this area is higher.

Revised Plan Alternatives

Management Direction under Alternatives B, C and E

As in the current plans, the wild horse territory would not be suitable for timber production in alternatives B, C and E, but vegetation management through activities such as timber harvest or fuels management may continue to be used. This would continue to achieve desired conditions such as for public safety, wild horse habitat enhancement, or ecological restoration. Permitted livestock grazing would continue to not be suitable in this area.

Under alternatives B, C and E, none of the following would be permitted: new roads or trails, new developed recreation facilities, new commercial mineral material permits, new energy/utility corridors, or new range improvements that attract horses into the adjacent the Lost Water Canyon Research Natural Area or the Lost Water Canyon Recommended Wilderness Area proposed in alternatives B and C.

Effects of Alternatives B, C and E

Management direction for the Territory is the same as in the existing plan, as described under the current plans. It is expected that vegetation management activities could have role in improving the condition of forested habitats even though they are not considered suitable for timber production. Wheeled motorized travel on designated roads would continue to be allowed.

Alternative D

Management Direction under Alternative D

Under alternative D, an expanded Lost Water Canyon Recommended Wilderness Area overlaps about 98 percent (4,311 acres) of the wild horse territory.

In alternative D, the area is not suitable for timber production and timber harvest is not allowed. Alternative D would be the same as the current plans and alternatives B, C, and E in that uses not allowed include new roads or trails, new developed recreation facilities, new mineral material permits, and new energy/utility corridors.

Under alternative D, new recreation events would not be allowed within the territory unlike the current plans and alternatives B, C, and E where they would be allowed. Under alternative D, new commercial filming and still photography would only be authorized for the purpose of promoting wilderness.

Effects of Alternative D

Under alternative D, management direction for the wild horse territory is the same as in the existing plan, and as described under alternatives B, C and E, except that Lost Water Canyon Recommended Wilderness would overlap with the. Effects are described below under Effects of Land Allocations section.

Lack of vegetation management through activities such as timber harvest or fuels management could place the herd in danger of large scale severe or high intensity wildfire. Improvement of forage resources from limited stand treatments would not be realized. Permitted livestock grazing would not be suitable under this alternative.

Allowing new commercial filming and still photography only for the purpose of promoting wilderness is counter to the widely popular existing uses of and expected demand for still photography and filming of wild horses.

Alternative D has a substantial negative effect on the wild horse management efficiency and the costs of managing wild horses because it brings greater administrative motorized, mechanized, and aircraft restrictions in recommended wilderness. Examples include, administrative bait trapping off-route, periodic administrative off-route weed control, administrative access to maintain wild horse infrastructure (such as water guzzlers and fences), and potential conflicts with aircraft options for wild horse counts and gatherers.

Consequences to the Pryor Mountain Wild Horse Territory from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Timber Management

Under all alternatives, the Pryor Mountain Wild Horse Territory is not suitable for timber production. Timber harvest, firewood gathering, and other vegetation management activities (such as prescribed fire) may only be allowed to maintain or achieve the desired conditions under the current plans and alternatives B, C, and E, and in only about 85 acres alternative D. Timber harvest activities that occur on the broader landscape could influence the type and severity of wildfire that enters the territory and influence the potential temporary displacement of wild horses.

Effects from Vegetation Management

Vegetation management activities may occur as guided and restricted by plan components, regulation, and policy under all alternatives except D. Plan component measures are expected to protect all qualities associated with these areas and to achieve desired conditions.

Any activities that may occur would have minimal impact to vegetation conditions, or be designed to maintain or restore natural conditions. Vegetation management activities that occur on the broader landscape could influence the type and severity of wildfire that enters the territory and influence the potential temporary displacement of wild horses.

Effects from Fire and Fuels Management

Fire is a primary natural ecosystem process, and all alternatives emphasize the importance of allowing such processes to occur. Prescribed fire and fire suppression tactics would adhere the Pryor Mountain Wild Horse Territory environmental assessment, decision notice, and the 2009 herd management plan as well as the Forest Service Manual 2260. Further, fires that occur on the broader landscape could influence the type and severity of wildfire that enters the territory and influence the potential temporary displacement of wild horses.

The current plans' direction are to contain, control, or confine wildfires in the territory. Revised plan alternative plan components for fire and fuels management would encourage an appropriate management response to wildfires that may occur in the territory, and provide opportunities for natural fire to alter the vegetation condition of the landscape.

If the values associated with the territory are at risk of degradation or loss due to fire, fire management strategies would likely include measures aimed at protecting those values, if possible. However, fire as a natural process may be desired and allowed to occur within the territory to perpetuate the natural functioning of the ecosystem. Effects from fire and fire management strategies are expected to have a positive effect on the condition and perpetuation of the ecological values associated with the wild horse territory.

Effects from Watershed, Soil, Riparian, and Aquatic Management

Activities related to watershed, soil, riparian, or aquatic habitat would generally not occur in the territory because there are no riparian management zones, and there would be little to no effect related to the management of these resources.

Effects from Invasive Species Management

Control of invasive weeds is an action that has occurred in the past and is expected to occur in the future. Plan components for invasive plant species would have a positive effect on wild horse habitat maintenance through the control of invasive weeds or prevention of their spread.

In all alternatives, treatment of noxious weeds ensures rangelands productivity would not be reduced or eliminated, thus benefiting wild horses by retaining the forage species upon which they are dependent. Controlling expansion of invasive species can occur through managing the appropriate management level requiring removals of wild horses or maintenance of the appropriate management level. In alternative D, the cost to control and manage invasive weeds would increase.

Effects from Permitted Livestock Grazing Management

Permitted livestock grazing is not suitable in the Pryor Mountain Wild Horse Territory in any alternative and there would be no effect related to livestock grazing. This also results in less competition for forage and water resources.

Effects of Land Allocations

Recommended wilderness areas are lands that have the potential to become designated as official wilderness through future legislation. The current plans and alternatives B, C and E do not have overlapping recommended wilderness areas with the territory. Under alternative D, about 4311 acres of the Lost Water Canyon recommended wilderness would overlap the territory (98 percent of the territory), leaving the Burnt Timber Road #2849 to bisect the recommended wilderness area.

Currently, routine wild horse management includes bait trapping, immuno-contraception darting, population counts, gathers, rangeland utilization and condition monitoring, research, and infrastructure maintenance. Under alternative D, administrative motorized, mechanized or low altitude aircraft use for needed management activities for wild horses, weed control, and vegetation management would only be allowed within 85 acres of the territory and would result in higher costs for these routine management needs in the remaining 4311 acres of the territory where the Recommended Wilderness Area overlaps.

Within the recommended wilderness contained in the wild horse territory under alternative D, there are two enclosures (for range studies) retained for wild horse monitoring needs. A historic wild horse trap structure exists along the Burnt Timber Road #2849 and is considered as a part of the historical and cultural landscape of the area. One proposed tank with a fence development around a snow catchment area that was approved in the 2009 Territory and Horse Management Area Plan Decision Notice would not be implemented within the recommended wilderness area under alternative D.

About 200 acres of the Lost Water Creek eligible Wild and Scenic River corridor (wild classification) overlaps the territory. For eligible rivers, on either bank a 0.25-mile wide corridor would be managed and protected. This small overlap occurs along the Lost Water Canyon, rim in the southwestern portion of the territory. Wild horse management would be compatible with the purposes of the wild classification for the Lost Water Creek eligible Wild and Scenic River corridor with little to no impact for wild horse management. However, vegetation management within the 200 acres of overlap would preclude timber harvest as a tool under all revised plan alternatives.

Effects from Access and Recreation Management

Recreational use is anticipated to increase, particularly to view wild horses. Plan components restricts motorized use along Burnt Timber Road 2849. Limiting motorized use along Burnt Timber Road minimizes disturbance or harassment to wild horses within the territory. Nonmotorized travel and recreational use is allowed elsewhere within territory. Unrestricted recreation activities could result in a situation where wild horses are impacted by visitation.

Issuance of filming permits has little effect on the wild horses. However, increased visitation from viewers of these commercial products results in higher visitation and public awareness. The wild horses and their habitat are expected to receive more amounts of disturbance during certain times of year such as in the spring during foaling.

If harassment of wild horses from recreationists occurs, seasonal road or area closures could be employed or citations, under 36 CFR 261.23(b) which prohibits harassment or inhumane treatment of wild horses, could be issued.

Summer and Winter Recreation Opportunity Spectrum: About 1,829 acres of semi-primitive, nonmotorized and 2,569 acres of semi-primitive, motorized summer and winter recreation opportunity spectrum settings are within the territory under the current plans and alternatives B, and E. About 35 acres of primitive, 1,792 semi-primitive, nonmotorized, and 2,569 acres of semi-primitive, motorized summer and winter recreation opportunity spectrum settings are within the territory under alternative C. About 4,311 acres of primitive and 85 acres of semi-primitive, motorized summer and winter recreation opportunity spectrum settings are within the territory under alternative D.

Managing for primitive or semi-primitive, nonmotorized recreation opportunities would not result in substantial impacts to wild horses or their habitat in these areas since administrative access for wild horse management and other multiple use management needs such as weed control would not be limited. Managing for semi-primitive, motorized or roaded natural opportunities would not result in substantial impacts to wild horses or their habitat and other multiple uses in these areas given plan component direction.

Effects from Scenery Management

The current plans would continue the visual quality objective of retention (comparable to a high scenic integrity objective) prescribed for the territory, which would have a small impact on activities in the territory.

The forest plan scenic integrity objectives under the revised plan alternatives do not prohibit on-the-ground actions, but may influence the design or the location of on-the-ground projects that would be visible from the listed critical viewing platform (Burnt Timber Road). Design features or mitigations may be required to meet or exceed the assigned scenic integrity objective, which describes the lowest threshold of visual dominance and deviation from the surrounding scenic character.

Under alternatives B, C, and E, the territory is located within an area assigned scenic integrity objectives of high. Wild horse management related infrastructure or landscape alterations should meet the assigned scenic integrity objectives as viewed from the listed critical viewing platform (Burnt Timber Road). These alternatives allow some flexibility in the type of management actions that could benefit wild horses than under alternative D.

Under alternative D, due to recommended wilderness, the assigned scenic integrity objectives of very high and may provide less flexibility than the current plans or alternatives B, C, or E, relative to wild horse management actions.

Cumulative Effects

The entire multi-jurisdictional Pryor Mountain Wild Horse Range boundary forms the geographic scope for cumulative effects. The overall Pryor Mountain Wild Horse Range is unique because a large portion of it was established under two secretarial orders in 1968 and 1969 on Bureau for Land Management (BLM) and National Park Service lands prior to the Wild Free-Roaming Horses and Burros Act of 1971. Pursuant to the 1971 act, the Forest Service territory was identified and the BLM herd areas were expanded as areas occupied by wild horses at the time of the passage of the 1971 act.

Under all alternatives, the Pryor Mountain Wild Horse Territory would contribute to the recognition of wild horses as an integral part of the area along with other multiple use considerations. Management activities will generally continue to take place within the territory, and it is unlikely that these activities would have an effect on the management of wild horses and associated multiple uses. The exception is under alternative D, which would substantially limit management flexibility, increase management difficulty, and increase costs in wild horse management in 98 percent of the territory (4,311 acres).

The Bureau of Land Management leaves the Burnt Timber Road closed at the same time period as the Forest Service does (during foaling period, April 15 to June 15), while allowing access up Sykes Ridge Road which adds to the protection of wild horses.

The adjacent Bureau of Land Management's (BLM) Burnt Timber Canyon, East Pryor, and Bighorn Tack-On Wilderness Study Areas provide protection from commercial development. The requirements for management as not to impair the wilderness characteristics limits wild horse and habitat management. Installation of projects to benefit wild horses and rehabilitation of impaired lands is limited. As a result of these BLM land allocations, there are periodic BLM requests for administrative motorized access on wild horse territory national forest lands to access their infrastructure (such as water guzzlers) for maintenance needs.

Conclusion

Plan components would be sufficient to maintain wild horses and their habitat in the designated Pryor Mountain Wild Horse Territory. All alternatives are consistent with the 1971 Wild and Free-Roaming Horses and Burros Act, 36 CFR 222, and direction in Forest Service Manual 2260.

Territory activities that overlap with Lost Water Canyon Recommended Wilderness Areas in alternative D would be compatible with these areas. However, to be compatible with recommended wilderness area plan component under alternative D, limitations on administrative motorized, mechanized, or aircraft uses in 98 percent of the territory (4,311 acres) would make wild horse management more difficult. Limited management actions include bait trapping, census efforts, immuno-contraception darting, weed treatment, installation of additional water source structures such as guzzlers, access to other lands for the purposes of wild horse management and multiple use consideration. Alternative D would also reduce the amount of area where vegetation management for wild horse habitat improvement and commercial permits (for example, commercial filming for wild horse purposes) could be conducted to about only two percent of the territory (85 acres).

Other overlapping land allocations (such as eligible wild and scenic river corridors) would be compatible with the territory. All alternatives provide for continuation of the Territory to be used by wild horses and other multiple uses.

3.21.11 Earthquake Lake Geologic Area

Affected Environment (Existing Condition)

In August 1959, an earthquake triggered a massive landslide, blocking the Madison River and forming Earthquake Lake. This earth-changing event, known as the Hebgen Lake earthquake, measured 7.5 on the Richter scale. At the time, it was the second largest earthquake to occur in the lower 48 states in the 20th century. Twenty-eight people lost their lives in the event.

The Madison River Canyon Earthquake Area was designated as a 37,800-acre geological area under the authority of the secretary of agriculture in 1960. Locally the name Earthquake Lake Geologic Area is more commonly used. The area was intended to allow the natural processes in to continue while providing for its use in conjunction with the safety and enjoyment of visitors.

The Earthquake Lake Visitor Center, located 27 miles northwest of West Yellowstone, Montana, was constructed in 1967 and is key in meeting the purposes of the designation to interpret and provide education about the 1959 earthquake, related events, and national forest resource management. The complex hosts exhibits, films, presentations, and interpretive trails focused on earthquakes, plate tectonics, and a working seismograph. In 2015, there were over 40,000 visitors at this site.

The natural attractions and the easily seen effects of the strongest earthquake in the Rocky Mountains made this area one of the outstanding scenic and geological study areas in the west.

Environmental Consequences

Current Plans

Management Direction under the Current Plans

The 1987 Gallatin Forest Plan has components that state the Madison River Canyon Earthquake Area was designated as a special geological area in 1960.

The plan components state the Madison River Canyon Earthquake Area will be managed to allow the natural processes in this area to continue while providing for its use in conjunction with the safety and enjoyment of visitors. It also encourages multiple use of this area consistent with the first statement and interpret the 1959 earthquake, related events, and national forest resource management for visitors through operation of the Quake Lake Visitor Information Center.

Effects of the Current Plans

Current direction provides for multiple use management while allowing for visitor use, a focus on education, and interpretation through operation of the visitor center and public safety.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

Plan components for the Earthquake Lake Geologic Area do not vary by alternative. These components maintain the same management as in the current plans, which is reflective of the designating language for the area. They provide for visitor education and interpretation, the operation of the visitor center and ensuring public safety. The area remains suitable for other multiple use projects while addressing the needs to retain the area for recreation and education.

Effects of the Revised Plan Alternatives

Similar to the current plans, the Earthquake Lake Geologic Area would continue to be managed for multiple use while providing for visitor use, a focus on education and interpretation through operation of the visitor center and public safety.

Consequences to Earthquake Lake Geologic Area from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Timber Management

Plan components for timber production would accommodate management for limited timber harvest as allowed under inventoried roadless area components and the geologic area for education, interpretation, and recreational use.

Effects from Fire and Fuels Management

Both natural and management-ignited fires could change the scenery visible from the Earthquake Lake Visitor Center and interpretive sites, including charred vegetation in the short term as well as re-growth in the longer term. The current plans' fire management direction are to consider multiple fire management strategies. To minimize resource damage, revised plan alternative fire, and fuel, the plan components call for minimum impact suppression tactics in sensitive areas, which would reduce scenic impacts from the suppression effort itself. Exceptions may occur when a more direct attack is needed to protect life or adjacent property or mitigate risks to responders.

Effects from Watershed, Riparian, and Aquatic Management

The revised plan alternatives provide more detailed guidance than the current plans for protection of watersheds, riparian areas, and aquatic habitats. The revised plan alternatives include the adoption of riparian management zones, which are greater in size from the riparian zones currently identified for streams east of the Continental Divide. Revised plan alternative plan components for aquatic resources would ensure any multiple use projects that occur in the geologic area would allow the natural processes in this area to continue as directed in the designation.

Effects from Access and Recreation Management

In all alternatives, plan components, including visitor education, would help to manage this geologic area to meet the direction for the designated area.

Cumulative Effects

The effects of growing populations, trends of increased recreational use, and recently demonstrated increased visitation to nearby Yellowstone National Park may predict an increase visitation to Earthquake Lake Geologic Area within the lifetime of the plan. The effect of this would be likely reflected in increased maintenance and staffing costs.

Conclusion

The current plans and the revised plan alternatives provide plan components for the Earthquake Lake Geologic Area that support the Secretary of Agriculture's designation by establishing guidance and direction to provide for education and the continued operation of the visitor center and surrounding interpretation.

The designation's direction of allowing the area's natural processes to continue while providing for the safety and enjoyment of visitors is accomplished. This includes the ongoing operation of the Earthquake Lake Visitor Center. The area remains suitable for other multiple use projects while addressing the needs to retain the area for recreation and education.

3.21.12 Continental Divide National Scenic Trail

Affected Environment (Existing Condition)

The Continental Divide National Scenic Trail, also known as the Continental Divide Trail, is a national scenic trail that runs 3,100 miles between Mexico and Canada. The trail was designated by Congress in 1978 and follows the Continental Divide of the Americas along the Rocky Mountains, traversing through five U.S. states: Montana, Idaho, Wyoming, Colorado, and New Mexico. The trail is a combination of dedicated trails and roads.

The Continental Divide National Scenic Trail is managed according to the National Trails Act, the Continental Divide National Scenic Trail Study Reports and final environmental impact statement, and the Continental Divide National Scenic Trail Comprehensive Plan (as amended) for the purpose of providing:

> A continuous, appealing trail route, designed for the hiker and horseman, but compatible with other land uses" and access for hikers and stock into the diverse country along the Continental Divide in a manner which will assure a high quality recreation experience while maintaining a constant respect for the natural environment.

Approximately 28 miles of the Continental Divide National Scenic Trail is located within the Custer Gallatin National Forest on the Hebgen Ranger District in the Madison, Henrys Lake, and Gallatin Geographic area abutting the Caribou-Targhee National Forest. The Continental Divide Trail on the Custer Gallatin is comprised of four trails: Two Top Divide 116, Lionhead Mountain Continental Divide National Scenic Trail 115, Mile Creek 214, and Mile Creek Face 219. The Continental Divide Trail is viewed as a stand-alone resource and opportunity that attracts visitors to the national forest who want to travel this trail. The trail provides for high-quality scenic, primitive hiking and horseback riding opportunities in the context of conserving the natural, historic, and cultural resources along its corridor. The segment of trail on the Custer Gallatin is open to mountain bikes and the Gallatin Forest Travel Plan allowed winter snowmobile use across and near the trail.

Environmental Consequences

Current Plans

Management Direction under the Current Plans

The 1987 Gallatin Forest Plan only referred to this route as a proposed trail. Current forest direction to manage the Continental Divide Trail is in accordance with the Continental Divide Trail Comprehensive Management Plan, as amended.

In the current plans, the recreational opportunity spectrum classification for the Continental Divide National Scenic Trail is semi-primitive nonmotorized, year-round. Approximately six miles of the route passes through the Lionhead Recommended Wilderness Area where plan components for that allocation apply. Mountain biking is allowed on the trail in the current plans.

Effects of the Current Plans

The Custer Gallatin would continue following the guidance in the Continental Divide Trail Comprehensive Management Plan. The six miles of trail within recommended wilderness are managed for wilderness characteristics, providing a primitive recreational opportunity spectrum experience.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

The plan components apply to one half mile on each side of the trail and do not vary by alternative. New roads, motorized events, and overnight shelter would not be authorized. The trail would not suitable for timber production. Summer motorized use would be allowed under very limited circumstances. Scenery protection measures would be in place for any long term impacts, achieving scenic integrity objectives of high or very high within the foreground of the trail (up to one half mile on either side).

The trail is within recommended wilderness area in alternative D and backcountry area in alternative E.

Effects of the Revised Plan Alternatives

The plan components would manage the Continental Divide National Scenic Trail within the parameters reached through the coordination of multiple forests and jurisdictions that the route crosses, and consistent with the Continental Divide Trail Comprehensive Management Plan, as amended.

The trail is within a recommended wilderness area in alternative D and backcountry area in alternative E. The recreational opportunity spectrum classification for the trail would be semi-primitive nonmotorized in the winter and summer in alternatives B, C and E and would be primitive in winter and summer in alternative D. Mountain biking would continue to be allowed on the trail in alternatives B, C and E. Mountain biking would no longer be a suitable use on the trail in alternative D.

Consequences to Continental Divide National Scenic Trail from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Timber and Vegetation Management

The current plans' components call for timber harvest consistent with trail management. The trail corridor is not suitable for timber production in the revised plan alternatives, and timber harvest may be allowed for purposes such as fuels reduction, restoration, or wildlife habitat enhancement. The revised plan alternatives provide more specific trail protections for timber harvest than the current plans by providing plan components that limit use of the trail corridor as a road or landing, and limit hauling or skidding materials across or near the trail.

Effects from Fire and Fuels Management

Both natural and management-ignited fires could change the scenery visible from the Continental Divide National Scenic Trail, including charred vegetation in the short term as well as re-growth in the longer term. The current plans' fire management direction are to consider multiple fire management strategies. To minimize resource damage, revised plan alternative fire and fuels plan components call for minimum impact suppression tactics in sensitive areas, such as the Continental Divide National Scenic Trail corridor, which would reduce scenic impacts from the suppression effort itself. Exceptions may occur when a more direct attack is needed to protect life, adjacent property, or to mitigate risks to responders.

Effects from Access and Recreation Management

In all alternatives, recreation opportunity spectrum sets guidance that is appropriate for the trail corridor.

Effects from Scenery Management

In revised plan alternatives, a scenic integrity objective of high applies to one half mile on each side of the trail, except in alternatives where the trail is in recommended wilderness and the scenic integrity objective is very high. In the Gallatin Forest Plan, scenery components states that the Continental Divide National Scenic Trail would follow whichever management area the trail is passing through.

In all alternatives, the forest plan scenic integrity objectives do not outright prohibit on-the-ground actions, but may influence the design or the location of on-the-ground minerals and energy projects that would be visible from any of the listed critical viewing platforms. Design features or mitigations may be required to meet or exceed the assigned scenic integrity objective, which describes the lowest maximum threshold of visual dominance and deviation from the surrounding scenic character

Effects from Minerals Management

The current plans have no specific minerals direction for the trail; there would be no saleable mineral material removal allowed in alternatives B through E.

Cumulative Effects

The 28 miles of the Continental Divide National Scenic Trail on the Custer Gallatin contribute to the experience of the entire 3,100-mile trail, in coordination with other managers of the trail, as it traverses various jurisdictions across a five state route. Most of the plan components resulted from previous coordination across the various national forests, which the trail crosses.

Conclusion

Plan components are sufficient to maintain the trail corridor in the designated Continental Divide National Scenic Trail, consistent with the Continental Divide Trail Comprehensive Management Plan, as amended.

The trail is within recommended wilderness area in alternative D and backcountry area in alternative E. Mountain biking would continue to be allowed on the trail in alternatives B, C and E. Mountain biking would not be allowed on the trail in alternative D.

3.21.13 Nez Perce National Historic Trail

Affected Environment (Existing Condition)

The Nez Perce National Historic Trail commemorates the 1877 flight of the non-treaty Nez Perce from their homelands in eastern Oregon, Idaho, and Washington across what are now the states of Idaho, Montana, and Wyoming. The Nez Perce (Nimíipuu or Nee-Me-Poo) National Historic Trail stretches from Wallowa Lake, Oregon, to the Bear Paw Battlefield near Chinook, Montana.

The Nez Perce Trail is interpreted along the Autotour Route; however, the Autotour Route is not necessarily the physical location of the Nez Perce Trail. Designated by Congress in 1986, the entire Nez Perce National Historic Trail stretches 1,170 miles from the Wallowa Valley of eastern Oregon to the plains of north-central Montana. The trail includes a designated corridor encompassing 4,161 miles of roads, trails, and routes. The auto route consists of three-season, all-weather roadways ranging from high-standard gravel segments to portions of Interstate 15 and 90. Nez Perce National Historic Trail signs have been erected along the primary auto route and two alternate segments.

The Nez Perce Auto Route on the Custer Gallatin can be found in two locations. The first section follows State Highway 20 from Targhee Pass to Yellowstone National Park, accounting for approximately 8 miles of the segment (from Leadore and Island Park to Yellowstone). The second section follows State Highway 212, from the Northeast Entrance of Yellowstone National Park, for approximately 8 miles, through Cooke City where it leaves the Custer Gallatin.

Environmental Consequences

Current Plans

Management Direction under the Current Plans

The Nez Perce National Historic trail was only listed as a proposed addition to the National Trail System in the 1987 Gallatin Forest Plan with direction to protect the integrity of the trail and provide the traveler with a wide variety of visual experiences.

Effects of the Current Plans

Under the current plans, management would continue to provide for the integrity of the trail.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

Plan components are the same for all revised plan alternatives. Revised plan alternatives provide more specific direction for interpretative materials for all eight segments of the route and coordinated management of the trail with other jurisdictions through which it passes.

Effects of the Revised Plan Alternatives

Forest plan components protect and enhance Nez Perce National Historic Trail Auto Route by providing for interpretive materials and coordinated route management.

Consequences to Nez Perce National Historic Trail from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Access and Recreation Management

The revised plan alternatives provide plan components for visitor education and interpretation that would help assure quality materials are available for this auto route and which provide an accurate historical overview of the setting. The current plans do not provide this direction.

Effects from Scenery Management

In all alternatives, the forest plan scenic integrity objectives (visual quality objectives in the current plans) do not outright prohibit on-the-ground actions, but may influence the design or the location of on-the-ground projects that would be visible. The Nez Perce auto tour route on Highway 20, between Targhee Pass and the Yellowstone National Park boundary, is listed as a critical viewing platform as well as the portion of Highway 212, Beartooth Highway. Design features or mitigations may be required to meet or exceed the assigned scenic integrity objective, which describes the maximum threshold of visual dominance and deviation from the surrounding scenic character.

Cumulative Effects

The 16 miles of the Nez Perce National Historic Trail Auto Route on the Custer Gallatin contribute to the experience of the entire 4,100-mile trail, in coordination with other managers of the trail.

Conclusion

Forest plan components protect and enhance Nez Perce National Historic Trail Auto Route by providing for interpretive materials and coordinated route management.

3.21.14 National Recreation Trails

Affected Environment (Existing Condition)

The Custer Gallatin National Forest has twelve national recreation trails, designated by the Regional Forester, as part of the national system of trails authorized by the National Trails Systems Act. National recreation trails provide a variety of outdoor recreation uses. Table 178 displays the trails by area, name, and mileage on the national forest and changes to uses by alternatives.

Table 178. Custer Gallatin national recreation trails

Trail Name	Rounded Miles[1]	Current Motorized/Mechanized Recreation Use Allowed	Changes to Uses by Alternatives
Basin Lakes National Recreation Trail	4	Mountain Bike	Portions closed to Mountain Bikes in Alternative D
Big Sky Snowmobile Trail National Recreation Trail	55	Motorized Recreation Use	None
Boulder River Natural Bridge National Recreation Trail	0.25	Mountain Bike	None
Gallatin Riverside National Recreation Trail	2.5	Mountain Bike	None
Garnet Mountain National Recreation Trail	4	Mountain Bike	None
Palisade Falls National Recreation Trail	0.6	No- foot only	None
Parkside Ski Touring National Recreation Trail	2.5	No	None
Refuge Point X-C Ski National Recreation Trail	5	No	None
Silver Run Ski Touring National Recreation Trail	5	No	None
Two Top Snowmobile National Recreation Trail	28	Motorized Recreation Use	None
Wild Bill’s Lake National Recreation Trail	0.5	Mountain Bike	None
Bridger Foothills Trail National Recreation Trail	20	Portions Motorcycle, entire length Mountain Bike	Portions closed to motorized/mechanized in Alternative D
Total	73	(no data)	(no data)

1. Mileage taken from more accurate and updated infra trail layers may be slightly different than forest plan or designated miles. A small piece of the U.S. Fish and Wildlife Service-managed Drinking Horse Trail crosses the national forest for less than 100 feet.

Environmental Consequences

Current Plans

Management Direction under the Current Plans

The Gallatin Forest Plan Management Area 23 provides direction for the existing and proposed national recreation and scenic trails on the Gallatin National Forest. The forest plan goal is to protect the integrity of the trails and provide the traveler with a wide variety of visual experiences. Most other plan components were moved to the Gallatin Travel Management Plan. The 1986 Custer Forest Plan did not include any national recreation trails direction.

Effects of the Current Plans

Current management components provide for protection and ongoing use of national recreation trails. Other agency-wide direction is provided in the Forest Service Trail Manual.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

One plan component is specific to national recreation trails in the revised plan alternatives and provides for public opportunities (such as interpretation and education) which do not impair the feature(s) or values for which the individual trail was established.

Effects of the Revised Plan Alternatives

Plan components do not vary by revised plan alternative, nor do the location of trails vary by alternatives. Under the revised plan alternatives, the national recreation trails would meet the purpose of the National Trails System Act, which is "to promote the preservation of, public access to, travel within, and enjoyment and appreciation of the open-air, outdoor areas and historic resources of the Nation."

The use of two national recreation trails would change in alternative D as a result of recommended wilderness area allocations. Portions of the Bridger Foothills National Recreation Trail and Basin Lakes National Recreation Trail would no longer be available for motorized or mechanized recreation use in alternative D.

Consequences to National Recreation Trails from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Vegetation and Timber Management

Some stretches of the trails may be located in areas where timber harvest could occur. The 1987 Gallatin Plan components call for timber harvest consistent with trail management; the 1986 Custer Plan has no specific guidance for national recreation trails. Revised plan alternatives vegetation plan components would help define the objectives for treatments that may occur near the trails.

Effects from Fire and Fuels Management

Both natural and management-ignited fires could change the scenery visible from the trails, including charred vegetation in the short term as well as re-growth in the longer term. The current plans' fire management direction are to consider multiple fire management strategies. To minimize resource damage, revised plan alternative fire and fuels plan components call for minimum impact suppression tactics in sensitive areas such as national recreation trails, which would reduce scenic impacts from the suppression effort itself. Exceptions may occur when a more direct attack is needed to protect life or adjacent property or mitigate risks to responders.

Effects from Watershed, Riparian, and Aquatic Management

The revised plan alternatives provide more detailed guidance than the current plans for protection of watersheds, riparian areas, and aquatic habitats. Plan components and activities related to aquatic would generally have little effect to national recreation trails. Where the trails cross or parallel streams, plan components related to riparian management zones would help maintain the natural character of those areas, and therefore complement the management of the trail.

Effects from Access, Infrastructure and Recreation Management

In all alternatives, Recreation opportunity spectrum settings are specified that are consistent with the desired conditions of the trails.

Effects from Scenery Management

In all alternatives, the forest plan scenic integrity objectives do not outright prohibit on-the-ground actions, but may influence the design or the location of on-the-ground projects that would be visible from any of the listed critical viewing platforms. In those cases, design features or mitigations may be required to meet or exceed the assigned scenic integrity objective, which describes the maximum threshold of visual dominance and deviation from the surrounding scenic character.

Cumulative Effects

The 12 national recreation trails on the Custer Gallatin contribute to a system of over 1,200 individual national recreation trails in all 50 states. National recreation trails benefit from the prestige and increased visibility of being a part of the National Trail System. National recreation trails can often compete well for additional funding or for state or Federal grant opportunities. A management approach listed in Appendix A of the revised plan suggests the Custer Gallatin could evaluate all currently listed National Recreation Trails to ensure they are being managed under the correct designation. If implemented, this action may change the number of national recreation trails if they are determined to not be the correct designation.

Conclusion

Under all alternatives, the twelve national recreation trails (NRT) would remain open and would continue to be managed for the values for which they were designated. In alternative D portions of the Bridger Foothills NRT and Basin Lakes NRT would no longer be available for motorized and/or mechanized use.

3.21.15 Beartooth Highway National Forest Scenic Byway and All-American Road

Affected Environment (Existing Condition)

The 67-mile Beartooth Highway (U.S. 212) starts at the Yellowstone National Park boundary in Montana, extends southeast into Wyoming, then ascends northeast toward the town of Red Lodge, Montana.

The Beartooth All-American Road is the highest elevation highway in Wyoming (10,947 feet) and Montana (10,350 feet), and is the highest elevation highway in the northern Rocky Mountains. It is known as one of the most scenic drives in the United States. The route features breathtaking views of the Absaroka and Beartooth Mountains, and open high alpine plateaus dotted with countless glacial lakes, forested valleys, waterfalls, and wildlife. Surrounded by national forest and wilderness, visitors to the Beartooth All-American Road are provided the unique opportunity to witness and explore pristine, untouched alpine and montane landscapes. Visitors in the Beartooth Corridor have ample access to recreation. Visitors can access skiing, hiking, wildlife viewing, fishing, camping, and snowmobiling in winter.

In 1931, Congress passed the Park Approach Act, which authorized the secretary of the interior to approve and construct national approach highways. The Beartooth Highway is the only road constructed under this act.

Since its completion in 1936, the highway has provided millions of visitors a rare opportunity to see the transition from a lush forest ecosystem to alpine tundra in the lower 48 states, with 20 peaks reaching over 12,000 feet in elevation space of just a few miles. In the surrounding mountains, glaciers are found on the north flank of nearly every mountain peak over 11,500 feet high. The Beartooth Highway generally receives the highest levels of vehicle traffic between Cooke City and the intersection of the U.S. 212 and Wyoming 296. This can be attributed to the convergence of travelers from both Red Lodge, Montana, via U.S. 212 and from Cody, Wyoming, via WY 296 west of the intersection of the two highways. Highest use is in August.

Environmental Consequences

Current Plans

Management Direction under the Current Plans

There is no specific direction in the Custer or Gallatin Forest Plans for management of the Beartooth Highway Scenic Byway or All-American Road resource.

The Beartooth Corridor is primarily rural and is managed by the Custer Gallatin National Forest and the Shoshone National Forest. The land is managed for a variety of uses, but primarily for recreation and wildlife habitat. Much of the Beartooth Highway is protected from development by a 250-foot withdrawal on each side of the road. Under Executive Order 5949, the corridor was withdrawn from settlement, location, sale, entry, or other disposal and was reserved for park approach road purposes.

The Beartooth All-American Road Corridor Management Plan (2002) articulates a vision of the communities for the scenic byway and represents a commitment to conserve and enhance its intrinsic qualities; it covers only the 53 miles of the All-American Road. It specifies the actions, procedures, operational and administrative practices, and strategies to maintain the natural, scenic, recreational, historic, cultural, and archaeological qualities of the byway corridor while recognizing the primary transportation role of the highway.

The Corridor Management Plan is a working document, therefore, it will be continually reviewed and revised as new information arises. The Corridor Management Plan is intended to be secondary, but consistent with National Forest Land Management Plan direction. The rest of the Beartooth Highway is also a national scenic byway with no current forest plan direction in the current plans.

Effects of the Current Plans

Under the current plans, the Beartooth Corridor will continue to be managed for its resource qualities, recreation, and transportation, as outlined in the Corridor Management Plan, Travel Plans, and Forest Service Manual Direction for management of national scenic byways.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

Plan direction does not vary by alternatives. The desired condition envisions the intrinsic scenic, natural, historical, cultural, archaeological, and recreational qualities for which the Beartooth National Forest Scenic Byway was designated are present on the scenic byway.

Effects of all Revised Plan Alternatives

Plan components demonstrate that the roadway would be managed for the values of a scenic byway.

Consequences to Beartooth Highway National Forest Scenic Byway and All-American Road from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Vegetation and Timber Management

In the current plans, timber harvest is limited to post, poles, and firewood as long as scenery is protected. The revised plan alternatives do not limit timber harvest. Vegetation and timber plan components would help define the objectives for treatments that may occur near the Beartooth Highway. Plan components would allow for vegetation treatments such as planting and weed spraying near the highway.

Effects from Fire and Fuels Management

Both natural and management-ignited fires could change the scenery visible from the Beartooth Scenic Byway, including charred vegetation in the short term as well as re-growth in the longer term. The current plans' fire suppression plan directions are to contain, control, and confine wildfires on the Beartooth Scenic Byway. To minimize resource damage, the revised plan alternatives fire and fuels plan components call for minimum impact suppression tactics in sensitive areas such as the Beartooth Scenic Byway. This would reduce scenic impacts from the suppression effort itself. Exceptions may occur when a more direct attack is needed to protect life or adjacent property or mitigate risks to responders.

Effects from Access and Recreation Management

In all alternatives, much of the Beartooth Highway is protected from development by a 250-foot withdrawal on each side of the road. Under Executive Order 5949, the corridor was withdrawn from settlement, location, sale, entry, or other disposal and was reserved for park approach road purposes.

Effects from Scenery Management

In all alternatives, the scenery of the Beartooth Highway is protected by the scenery plan components. In the current plans, the highway is assigned a visual quality objective of retention (equivalent to a high scenic integrity objective). In the revised plan alternatives, scenic integrity objectives of high or moderate apply one half mile on each side of the highway, protecting the scenery in the foreground.

In all alternatives, the forest plan scenic integrity objectives do not outright prohibit on-the-ground actions, but may influence the design or the location of on-the-ground minerals and energy projects that would be visible from any of the listed critical viewing platforms. Design features or mitigations may be required to meet or exceed the assigned scenic integrity objective, which describes the lowest maximum threshold of visual dominance and deviation from the surrounding scenic character

Cumulative Effects

Growing populations, the increase in tourism to Yellowstone National Park and the increase in the activity labeled “driving for pleasure,” all demonstrate a likelihood for increasing travel demands on the Beartooth Highway. The age of the roadway would likely show the need for increasing reconstruction of crucial infrastructure. The road is located at very high elevations and winter damage is often a factor. The costs of operating this route would also likely increase in coming years. The towns of Cooke City and Red Lodge are very dependent on this road for summer tourism. Longer seasons of keeping the road open benefits local economies, warming temperature may result in longer operating seasons.

Conclusion

The entire 67-mile length of the Beartooth Highway is a national forest scenic byway with a 53-mile segment also being an All-American Road. Forest plan components would apply to the entire length and ensure the roadway would be managed for the values of this scenic byway. The Beartooth All-American Road Corridor Management Plan coordinates management with the Shoshone National Forest, Montana Highway Department, Red Lodge Chamber of Commerce, and Carbon Country Planning Department. This allows more site specific and seasonal discussions to be held concerning decisions about the roads operation and maintenance.

3.22 Forest Plan Land Allocations

3.22.1 Introduction

Land allocations are developed in the forest planning process; these allocations are not designed by statute, regulation, or policy. This section analyzes the effects of a range of alternatives for recommended wilderness areas, eligible wild and scenic rivers, backcountry areas, recreation emphasis areas, and Stillwater Complex.

Two of these land allocations are potential future congressional designations. The 2012 Planning Rule requires all forest plans undergoing a plan revision to conduct an evaluation and determine if there are areas of the national forest that should be recommended to Congress as wilderness. The rule also calls for an evaluation of all named rivers on the national forest to see if they meet the eligibility status under the Wild and Scenic Rivers Act.

The wilderness recommendation process occurs in four primary steps: inventory, evaluation, analysis, and recommendation. All plan revisions must complete this process before the responsible official determines whether to recommend lands within the national forest to Congress for wilderness designation.

For a river to be identified as eligible for wild and scenic river designation it must (1) be free-flowing, and (2) possess at least one outstandingly remarkable value. Once identified, a corridor of ¼ mile on either side of the eligible river/river segment is identified for the protection and management of the wild and scenic river-related values. For management purposes, identified eligible wild and scenic river segments are assigned a preliminary classification as wild, scenic, or recreational. Pending congressional action to designate additional rivers, the forest plan allocation would manage these as eligible rivers, under all revised plan alternatives.

Regulatory Framework

36 CFR 219.7 – Planning Rule: states that in developing a proposed plan revision, the responsible official shall identify existing designated areas and determine whether to recommend any additional areas for designation. Forest plans must include components for appropriate management of existing or proposed designated areas.

36 CFR 219 sec. 219.7: requires the following during revision of a forest plan: identify and evaluate lands that may be suitable for inclusion in the National Wilderness Preservation System and determine whether to recommend any such lands for wilderness designation.

Forest Service Handbook 1909.12 chap. 70: contains the framework for the wilderness recommendation process. It states in part "All plan components applicable to a recommended area must protect and maintain the social and ecological characteristics that provide the basis for wilderness recommendation."

36 CFR Part 219 sec. 219.10(b)(1)(v): requires plan components to provide protection of designated wild and scenic rivers as well as management of rivers found eligible or determined suitable for the national wild and scenic river system.

Forest Service Handbook (FSH) 1909.12 Chapter 80 Wild and Scenic River Eligibility: provides additional guidance for conducting a wild and scenic rivers eligibility study for the national forest.

Forest Service Manual 2350: provides direction on the management of wild and scenic rivers.

Wild and Scenic Rivers Act of October 2, 1968 (Pub. L. 90-542, 82 Stat. 906, as amended): establishes the national wild and scenic rivers system with three classes of river systems: wild, scenic, and recreational. The purpose of the act is to protect the river "for the benefit and enjoyment of present and future generations."

Key Indicators and Measures

- Acres and percent of recommended wilderness
- Acres of inventoried roadless area within recommended wilderness
- Acres no longer suitable for motorized oversnow vehicle use in recommended wilderness
- Miles of trails no longer suitable for wheeled motorized use in recommended wilderness
- Miles of trails no longer suitable for mechanized transport in recommended wilderness
- Miles of eligible wild and scenic rivers
- Acres and percent of backcountry areas
- Acres and percent of Recreation Emphasis Areas
- Acres and percent of Stillwater Complex

Methodology and Analysis Process

The analysis evaluated potential changes to existing uses and potential new uses that would not be allowed in proposed land allocations. The analysis also measured the overlap of existing inventoried roadless areas with proposed land allocations to display the degree to which some uses are already limited in some proposed land allocations.

The analysis assumed that if Congress took action on some recommended wilderness areas, those not designated as wilderness would retain a forest plan allocation of recommended wilderness area. Also, that if Congress took action on some eligible wild and scenic rivers, those not designated as a wild and scenic river would retain a forest plan allocation of eligible wild and scenic rivers. The analysis assumed areas designated as inventoried roadless areas will remain so for the lifetime of the revised forest plan.

Information Sources

Information sources include the Custer Gallatin's GIS data, INFRA database, the National Visitor Use Monitoring program, and site-specific knowledge from forest personnel.

The use of modern day geographic information system (GIS) mapping technology resulted in a refinement of acres for the current forest plans' recommended wilderness areas. Plan revision calculations resulted in a difference of 1 to nearly 100 acres from the current forest plans acreages. During analysis, where the actual boundaries have not changed, these calculation differences were treated as no change from existing condition.

A comprehensive spatial layer of authorized special uses does not currently exist on the Custer Gallatin National Forest. These uses were individually evaluated for appropriateness of remaining in recommended wilderness areas upon completion of the forest plan revision.

Analysis Area

The geographic scope of the analysis is the lands administered by the Custer Gallatin. The scope for cumulative effects is described in the cumulative effects section of each forest plan allocation, and the temporal scope is the anticipated life of the plan.

3.22.2 Recommended Wilderness Area

Affected Environment (Existing Condition)

Recommended wilderness areas are lands that contain wilderness characteristics and have potential for inclusion in future wilderness designations, if Congress takes action to introduce and pass legislation. These lands are generally free from roads and other constructed features and have high potential to provide solitude and primitive, unconfined recreation. Recommended wilderness areas are also important for species diversity, protection of threatened and endangered species, protection of watershed, scientific research, and various social values.

Environmental Consequences

Recommended wilderness areas are drawn from lands in the wilderness inventory prepared for forest plan revision. Appendix D of the 2018 Proposed Action displays the lands in the wilderness inventory as well as an evaluation of these lands.[19] There may be ongoing management activities on the lands in the wilderness inventory; these activities do not preclude the consideration of these lands as recommended wilderness.

Table 179 displays the recommended wilderness areas and their acreage in each alternative.

Table 179. Acres of recommended wilderness areas by alternative

Name	Geographic Area	Alternative A	Alternative B	Alternative C	Alternative D
Cook Mountain	Ashland	0	0	0	9,794
King Mountain	Ashland	0	0	0	10,502
Tongue River Breaks	Ashland	0	0	0	16,883
Bear Canyon	Pryor Mountains	0	0	0	10,366
Big Pryor	Pryor Mountains	0	0	0	12,737
Lost Water Canyon	Pryor Mountains	6,804	6,804	6,804	12,992
Punch Bowl	Pryor Mountains	0	0	0	7,766
Burnt Mountain	Absaroka Beartooth Mountains	3,917	0	0	0
Chico Peak	Absaroka Beartooth Mountains	0	0	0	7,036
Deckard Flats	Absaroka Beartooth Mountains	0	0	0	935
Deer Creek	Absaroka Beartooth Mountains	0	0	0	85,444
Dome Mountain	Absaroka Beartooth Mountains	0	0	0	9,540
East Rosebud to Stillwater	Absaroka Beartooth Mountains	0	0	0	17,422
Emigrant Peak	Absaroka Beartooth Mountains	0	0	0	15,829
Knowles Peak	Absaroka Beartooth Mountains	0	0	0	1,223
Line Creek Plateau	Absaroka Beartooth Mountains	809	801	801	26,605
Mount Rae	Absaroka Beartooth Mountains	0	0	0	2,839
Mystic	Absaroka Beartooth Mountains	247	247	247	136
North Fork	Absaroka Beartooth Mountains	0	0	0	36
Phelps Creek	Absaroka Beartooth Mountains	0	0	0	3,177
Red Lodge Creek	Absaroka Beartooth Mountains	0	0	0	12,039
Red Lodge Creek/Hell Roaring	Absaroka Beartooth Mountains	802	802	802	0

[19] https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd567792.pdf

Name	Geographic Area	Alternative A	Alternative B	Alternative C	Alternative D
Republic	Absaroka Beartooth Mountains	388	388	388	388
Sheep Creek	Absaroka Beartooth Mountains	0	0	0	557
Strawberry Creek	Absaroka Beartooth Mountains	0	0	0	11,597
Tie Creek	Absaroka Beartooth Mountains	0	0	0	5,886
West Fork Rock Creek	Absaroka Beartooth Mountains	0	0	0	12,470
West Woodbine	Absaroka Beartooth Mountains	0	0	0	1,091
Blacktail Peak	Bridger, Bangtail, and Crazy Mountains	0	0	0	6,147
Crazy Mountains	Bridger, Bangtail, and Crazy Mountains	0	0	0	59,636
West Bridger	Bridger, Bangtail, and Crazy Mountains	0	0	0	26,106
Buck Creek	Madison, Henrys Lake, and Gallatin Mountains	0	0	0	28,966
Cabin Creek North	Madison, Henrys Lake, and Gallatin Mountains	0	0	0	17,092
Cabin Creek South	Madison, Henrys Lake, and Gallatin Mountains	0	0	0	19,272
Cowboy Heaven	Madison, Henrys Lake, and Gallatin Mountains	0	0	15,536	14,357
Gallatin	Madison, Henrys Lake, and Gallatin Mountains	0	0	99,415	193,709
Gallatin Crest	Madison, Henrys Lake, and Gallatin Mountains	0	67,633	0	0
Lionhead	Madison, Henrys Lake, and Gallatin Mountains	20,774	17,983	15,738	31,389
Sawtooth Mountain	Madison, Henrys Lake, and Gallatin Mountains	0	14,828	0	0
Spanish Peaks East	Madison, Henrys Lake, and Gallatin Mountains	0	0	0	5,861
Spanish Peaks South	Madison, Henrys Lake, and Gallatin Mountains	0	0	0	2,845
Taylor Hilgard	Madison, Henrys Lake, and Gallatin Mountains	0	4,466	6,824	4,466
Yankee Jim Lake	Madison, Henrys Lake, and Gallatin Mountains	0	0	0	6,292
Total Acres	0	33,741	113,952	146,555	711,425

Alternative E has no recommended wilderness areas
Alternative A represents the current plans with projections if retained

Current Plans

Management Direction under the Current Plans

Both the 1986 Custer Forest Plan and 1987 Gallatin Forest Plans list recommended wilderness areas (RWA). Currently the Custer Gallatin National Forest manages seven different (recommended wilderness areas). Five of these are small areas under 5,000 acres are attached to either the already designated Absaroka Beartooth Wilderness or the North Absaroka Wilderness on the Shoshone National Forest. One 6,800 acre area is located in the Pryor Mountains, and the final area is over 20,000 acres in the Henrys Lake Mountains. In total there are 33,741 acres of recommended wilderness in the current plans.

All of the acres within recommended wilderness areas in this alternative are also inventoried roadless areas. Table 180 displays the recommended wilderness areas in the current plans, their acreage and the geographic areas in which they are located, as well as recommended wilderness areas acres within inventoried roadless areas.

Table 180. Current plans' recommended wilderness acres by geographic area, total acres, and inventory roadless area acres

Recommended Wilderness Area	Geographic Areas	RWA Acres	RWA acres in Inventoried Roadless Area	Percent of RWA in IRA
Lost Water Canyon	Pryor Mountains	6,804	6,804	100
Mystic	Absaroka Beartooth Mountains	247	247	100
Burnt Mountain	Absaroka Beartooth Mountains	3,917	3,917	100
Red Lodge Creek Hell Roaring	Absaroka Beartooth Mountains	802	802	100
Line Creek Plateau	Absaroka Beartooth Mountains	809	809	100
Republic Mountain	Absaroka Beartooth Mountains	388	388	100
Lionhead	Madison, Henrys Lake, Gallatin Mountains	20,774	20,744	100
Total Acres	No Data	33,741	33,741	100

RWA is recommended wilderness area; IRA is inventory roadless area

The 1986 Custer Forest Plan's Management Area H goal requires the retention of the wilderness character until a congressional decision is made regarding wilderness classification. Plan components close the recommended wilderness areas to motorized vehicles, and no new roads or trails are allowed. The recommended wilderness areas are not suitable for timber production; limited cutting of trees is allowed to maintain existing trail structures. Fire control options are varied, however prescribed fire is not allowed. Some components call for specific actions to increase wilderness character, such as the phase out of the Mystic Lake Boating Association special use permit and closure of the two-track road (jeep trail) in the Pryor Mountains to Tony Island Spring, both of which are accomplished.

A 1987 Gallatin Forest Plan forest-wide goal is to manage the existing and recommended wilderness resource to maintain its wilderness character and to provide for its use and protection. Management Area 4 direction is to manage recommended wilderness to protect the wilderness characteristics and to allow existing uses pending congressional action on their classification. There are two appendixes, F-1 and F-2, which give detailed direction for the Absaroka Beartooth and Lee Metcalf Wildernesses.

Management activities in grizzly bear habitat are to continue recovery of the bear, administrative cabins will be retained for management purposes but will not be rented to the public, prescribed fire is allowed, areas are unsuitable for timber production and generally no measures will be undertaken for insect and disease management unless epidemic populations exist and adjacent lands are severely threatened.

All seven recommended wilderness areas are mapped and managed as semi-primitive-non-motorized recreational opportunity spectrum. Motorized recreation uses including motorized winter over-snow use is not suitable within recommended wilderness areas. Within the Lionhead Recommended Wilderness, mountain biking use is allowed on several trails; mountain biking is not a suitable use in the other recommended wilderness areas. There are no mineral rights or oil and gas leases within recommended wilderness area in this alternative.

Effects of the Current Plans

The current plans have less recommended wilderness area than alternatives B, C, and D and more than alternative E and therefore it would provide the fourth highest amount of recommended wilderness area of the alternatives.

In the current plans, the seven current recommended wilderness area continue to be managed per the 1986 and 1987 forest plans. In the years since the original forest plans were completed, Congress has not taken action to either designate or release those areas recommended to be wilderness. They remain recommended to Congress to become designated wilderness. The 33,741 acres of recommended wilderness area in the current plans are not suitable for motorized winter over-snow recreational travel.

Natural disturbances and changes in recreation use patterns may continue to influence the wilderness character of these areas. None of the recommended wilderness areas in the current plans have outstanding or reserved mineral rights, oil and gas leases, or mining claims. Mechanized recreation use such as mountain biking would continue to be allowed on 10.9 miles of trail in the Lionhead Recommended Wilderness Area. There are existing minor grazing facilities such as fence lines and water developments in the Lionhead Recommended Wilderness Area. Most of the recommended wilderness areas include use under outfitter guide permits. There are no state lands and private inholdings in recommended wilderness areas in the current plans. Prescribed fire on the five recommended wilderness areas under direction of the Custer Forest Plan is prohibited, while that action is allowed on the two recommended wilderness areas under the direction of the 1987 Gallatin Forest Plan.

Mechanized transport (such as, bicycles) may affect the undeveloped nature (ecological characteristic) and primitive recreation (social characteristic) where recommended wilderness is essentially without permanent improvements or modern human occupation and social characteristics of primitive recreation. Not every person traveling through the Lionhead Recommended Wilderness Area would meet a mountain biker. Any type of trail, whether for hikers or horseback riders, can affect the undeveloped characteristics (ecological characteristics) as a trail is considered a development. Solitude can be affected by noise, but also can be affected by encountering other people who are hiking or horseback riding.

Under the current plans, there are 6,804 recommended wilderness area acres in the Pryor Mountains or nine percent of the total geographic area. There are a total of 6,163 recommended wilderness area acres in the Absaroka Beartooth Mountains Geographic Area or less than half of a percent of that total geographic area. Finally, there are 20,774 acres or about three percent within recommended wilderness area in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area.

Table 181 summarizes the effects of recommended wilderness area in the current plans.

Table 181. Recommended wilderness area indicators for the current plans

Indicators	Unit of Measure
Acres and percent of total National Forest within recommended wilderness areas	33,741 acres; 1.1%
Acres and percent of inventoried roadless area within recommended wilderness	33,741 acres; 100%;
Acres of motorized over-snow vehicle use areas in recommended wilderness	0 acres
Miles of wheeled recreational motorized use in recommended wilderness	0 miles
Miles of trails that allow recreational mechanized transport in recommended wilderness	17.52 miles
Miles of trails that would be closed to mechanized transport in recommended wilderness	0 miles
Existing facilities	minor grazing infrastructure

Alternative B

Management Direction under Alternative B

Nine areas would be recommended as wilderness for a total of 113,952 acres. Alternative B would not include one area included in the current plans, the 3,917 acres in Burnt Mountain west of the Red Lodge Mountain Ski Area. Lionhead recommended wilderness area is 2,791 acres smaller in alternative B than the current plans, and excludes the Continental Divide National Scenic Trail corridor. The other five recommended wilderness areas from the current plans are carried forward and three additional recommended wilderness areas are added. The Sawtooth Recommended Wilderness Area is 14,828 acres and the Gallatin Crest Recommended Wilderness Area is 67,358 (the Sawtooth and Gallatin Crest recommended wilderness areas are adjacent to each other). The 4,466 acres Taylor Hilgard Recommended Wilderness Area is adjacent to the south end of the Taylor Hilgard unit of the designated Lee Metcalf Wilderness.

Ninety-eight percent of recommended wilderness areas in alternative B are also within inventoried roadless areas. Table 182 displays the recommended wilderness areas in alternative B, their acreage and the geographic areas in which they are located, as well as recommended wilderness area acres within inventoried roadless areas.

Under alternative B, most of the recommended wilderness areas would be managed as semi-primitive-non-motorized rather than primitive recreational opportunity spectrum because of the need to manage and enhance conditions. For example, many of these recommended wilderness areas currently have a higher level of trail development and management structures (bridges, signs, etc.) than a desired condition for primitive recreational opportunity spectrum. The proposed Taylor Hilgard Recommended Wilderness Area would be managed as semi-primitive-non-motorized summer recreational opportunity spectrum, and semi-primitive- motorized winter recreational opportunity spectrum. About 900 acres of the proposed Gallatin Crest Recommended Wilderness Area is in winter motorized recreational opportunity spectrum categories; the remainder is semi-primitive non-motorized in summer and winter. Existing motorized and mechanized recreation uses (such as, mountain bikes), including motorized winter over-snow use would be suitable within recommended wilderness areas. In all recommended wilderness areas, administrative use of mechanical or motorized equipment would be allowed to accomplish restoration activities and maintenance of trails.

Table 182. Alternative B recommended wilderness area (RWA) acres by geographic area, total acres and inventory roadless area acres

Recommended Wilderness Area	Geographic Area	RWA Acres	RWA acres in Inventoried Roadless Area	Percent of RWA in IRA
Lost Water Canyon	Pryor Mountains	6,804	6,595	100
Mystic	Absaroka Beartooth Mountains	247	205	100
Red Lodge Creek Hell Roaring	Absaroka Beartooth Mountains	802	802	100
Line Creek Plateau	Absaroka Beartooth Mountains	801	801	100
Republic Mountain	Absaroka Beartooth Mountains	388	388	100
Lionhead	Madison, Henrys Lake, Gallatin Mountains	17,983	17,834	100
Gallatin Crest	Madison, Henrys Lake, Gallatin Mountains	67,633	66,768	99
Sawtooth Mountain	Madison, Henrys Lake, Gallatin Mountains	14,828	13,827	93
Taylor Hilgard	Madison, Henrys Lake, Gallatin Mountains	4,466	4,465	100
Total Acres	No Data	113,952	111,953	98

Recommended wilderness areas are not suitable for timber production and timber harvest is not allowed. Prescribed fire may be used as a restoration tool. Rental of national forest cabins would not be suitable. Recommended wilderness areas would not be suitable for recreational and commercial drone launching and landings. Drone use may be allowed for administrative purposes or in approved research projects. This direction on drones does not vary in the revised plan alternatives.

Recommended wilderness areas would not be suitable for new commercial communication sites or new recreation special use events, while continued use of existing commercial communication sites would be suitable.

Effects of Alternative B

Alternative B proposed 113,952 acres of recommended wilderness area; less than alternatives C and D and more than alternatives A and E and it therefore it would provide the third highest amount of recommended wilderness area of the alternatives.

There are no existing motorized trails in proposed recommended wilderness area in alternative B. About 20 miles of trails would continue to allow mechanized transport; about 11 miles in the proposed Lionhead Recommended Wilderness Area and about 9 miles in the proposed Sawtooth recommended wilderness area. The mountain bike trails in the Sawtooth Recommended Wilderness Area are currently inaccessible to mountain bike use because they are located between private land with no public access and Yellowstone National Park which does not allow mountain bike use on its trails. The proposed Taylor Hilgard Recommended Wilderness Area and about 900 acres of the Gallatin Crest Recommended Wilderness Area would continue to be mapped as semi-primitive-motorized winter recreational opportunity spectrum categories which reflects the an area is legally open to snowmobiling, although the winter recreational opportunity spectrum mapping does not consider topography, access or consistent snow.

Mechanized transport (such as, bicycles) and motorized uses may affect the undeveloped nature (ecological characteristic) and primitive recreation (social characteristic) where recommended wilderness is essentially without permanent improvements or modern human occupation and social characteristics of primitive recreation. In addition, winter motorized uses such as over-snow vehicle use, can impact the solitude and primitive recreation (social characteristics).

Not every person traveling through these recommended wilderness areas would meet a mountain biker or snowmobiler. Any type of trail, whether for hikers or horseback riders can affect the undeveloped characteristics (ecological characteristics). Solitude can be affected by noise but also can be affected by encountering other people who are hiking or horseback riding.

Developed recreation sites would not be suitable in alternative B. This would discontinue the operation of the Windy Pass cabin under the recreation rental cabin program. If the cabin is not needed for administrative purposes, it would be evaluated for removal. There are an additional 26 rental cabins and lookouts that would continue on the Custer Gallatin. The Buffalo Horn Administrative cabin, a historic structure in use administratively within the Gallatin Crest recommended wilderness area, may be allowed to remain within this recommended wilderness area, but would need to undergo separate evaluation to determine the appropriateness of retaining such a structure. There are no current recreation event special use permits located within recommended wilderness area in alternative B's boundaries.

Commercial communication sites such as cell phone towers would continue, and the Forest Service would provide reasonable access for their maintenance. In alternative B there are three authorized communication uses within the Gallatin Crest Recommended Wilderness Area. Two of these sites are single user sites located on Steamboat Mountain and Twin Peaks. The third is a Forest Service building and tower at the Eaglehead Communication Site. Gallatin County, Montana Department of Transportation and a private commercial user are co-located in this Forest Service building.

All but approximately 2,000 acres of the recommended wilderness areas in this alternative are also inventoried roadless areas. Under alternative B, there are 6,804 recommended wilderness area acres in the Pryor Mountains or nine percent of the total geographic area. There are a total of 2,238 recommended wilderness area acres in the Absaroka Beartooth Mountains Geographic Area or less than half of a percent of that total geographic area. Finally, there are 104,910 acres or about thirteen percent within recommended wilderness area in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area.

The Custer Gallatin National Forest obtained lands through purchase or exchange, where the Federal government did not also obtain the mineral rights to those acres. "Reserved" mineral rights are retained by the grantor; "outstanding" mineral rights are held by other (third parties) than the owner or grantor. The rights to explore and develop minerals on those lands are not prohibited by a forest plan recommended wilderness area. Therefore, any lands such as these within a recommended wilderness area has the potential for future access and mineral development. While future mineral development may occur where valid existing or statutory rights exist, energy and mineral resources plan components state that mineral activities consider other resources values which may be present. The probability of an entity exerting those held mineral rights for exploration or development is not predicable.

Table 183 below displays the acres of mineral encumbrances, including outstanding mineral rights, reserved mineral rights, oil and gas leases and whether there are mining claims within recommended wilderness areas proposed in alternative B. Reasonable access and other mineral activities may occur in areas with mineral encumbrances, even if plan components for recommended wilderness state that no new roads or structures could be constructed.

Table 183. Alternative B recommended wilderness area (RWA) acres and presence of mineral encumbrances

Recommended Wilderness Area	RWA Acres	Acres Outstanding Mineral Rights	Acres Reserved Mineral Rights	Acres Oil and Gas Leases	Mining Claims Present
Lost Water Canyon	6,804	0	0	none	no
Mystic	247	0	0	none	no
Red Lodge Creek Hell Roaring	802	0	0	none	no
Line Creek Plateau	801	0	0	none	no
Republic Mountain	388	0	0	none	no
Lionhead	17,983	0	0	none	no
Gallatin Crest	67,633	1,804	3,823	none	no
Sawtooth Mountain	14,828	604	4,667	none	no
Taylor Hilgard	4,466	0	0	none	no
Total Acres	113,952	2,408	8,490	0	0

Table 184 summarizes the effects of recommended wilderness area in alternative B.

Table 184. Recommended wilderness area indicators for alternative B

Indicators	Unit of Measure
Acres and percent of total national forest within recommended wilderness	113,952 acres; 3.7%
Acres and percent of inventoried roadless area within recommended wilderness	111,953 acres; 98%;
Acres of motorized over-snow vehicle use areas in recommended wilderness	5,385 acres
Miles of trails that allow recreational mechanized transport in recommended wilderness	20miles
Miles of trails no longer available to recreational mechanized transport in recommended wilderness	0 miles
Existing special use permits or facilities.	Windy Pass rental cabin Buffalo Horn admin cabin Steamboat Mtn., Twin Peaks, Eaglehead communication uses

Alternative C

Management Direction under Alternative C

Nine areas would be recommended as wilderness as alternative C, for a total of 146,555 acres. Lionhead Recommended Wilderness Area is 5,036 acres smaller in alternative C than the current plans and 2,245 acres smaller than alternative B. The five recommended wilderness areas from the current plans (that were included in alternative B) would also be included in alternative C and three additional recommended wilderness areas would be added.

The 99,136 acre Gallatin Recommended Wilderness Area is now joined with the Sawtooth Recommended Wilderness Area of alternative B, and at 31,778 acres is about one third bigger than alternative B Gallatin Crest Recommended Wilderness Area. The 6,824 acre Taylor Hilgard Recommended Wilderness Area is larger by 2,358 acres than in alternative B. The Cowboy Heaven Recommended Wilderness Area is 15,536 acres in this alternative.

Ninety-seven percent of recommended wilderness areas in alternative C are also within inventoried roadless areas.

Table 185 displays the recommended wilderness areas in alternative C, their acreage and the geographic areas in which they are located, as well as recommended wilderness area acres within inventoried roadless areas.

Table 185. Alternative C recommended wilderness area acres by geographic area, total acres and inventory roadless area acres

Recommended Wilderness Area	Geographic Areas	RWA Acres	RWA acres in Inventoried Roadless Area	Percent of RWA in IRA
Lost Water Canyon	Pryor Mountains	6,804	6,595	97
Mystic	Absaroka Beartooth Mountains	247	205	83
Red Lodge Creek Hell Roaring	Absaroka Beartooth Mountains	802	802	100
Republic Mountain	Absaroka Beartooth Mountains	388	388	100
Line Creek Plateau	Absaroka Beartooth Mountains	801	801	100
Lionhead	Madison, Henrys Lake, Gallatin Mountains	15,738	15,589	99
Cowboy Heaven	Madison, Henrys Lake, Gallatin Mountains	15,536	15,489	99
Gallatin	Madison, Henrys Lake, Gallatin Mountains	99,415	96,601	97
Taylor Hilgard	Madison, Henrys Lake, Gallatin Mountains	6,824	6,104	89
Total Acres	No Data	146,555	142,574	97

RWA is recommended wilderness; IRA is inventory roadless area

Under alternative C, motorized and mechanized recreation uses (such as, mountain bikes), including motorized winter over-snow use, and continued use of commercial communication sites are not suitable within recommended wilderness areas. Administrative use of mechanical or motorized equipment is allowed to accomplish restoration activities and maintenance of trails. Recommended wilderness areas are not suitable for developed recreation sites, except for the continued use of the Windy Pass Cabin as a recreation rental cabin, and all recommended wilderness areas would be managed as primitive recreational opportunity spectrum. Under this primitive recreational opportunity spectrum desired condition, trails, signs and infrastructure would be managed to a lower condition than currently exists. This would result, for example, in a setting managed to feature for challenge, self-reliance and route-finding experiences, compared to one of managing for visitor safety, ease and comfort.

Effects of Alternative C

Alternative C recommends 146,555 acres of recommended wilderness area; less than alternative D and more than alternatives A, B, and E and therefore would provide the second highest amount of recommended wilderness area of the alternatives.

There are no existing motorized trails within recommended wilderness area in alternative C. Mountain bike use would no longer be suitable on about 14 miles of trail currently open to mountain bikes. Alternative C boundaries for the Lionhead Recommended Wilderness Area excludes all but 1.5 miles of mountain bike trails; the spur trail to Coffin Lake would be closed to mountain bike use in this alternative. Cowboy Heaven Recommended Wilderness Area contains 3.5 miles of mountain bike trails; Gallatin Recommended Wilderness Area in the Sawtooth area contains nine miles of mountain bike trails, for a total of 14 miles of bike trails in alternative C. Based on semi-primitive-motorized winter recreational opportunity spectrum mapping (which reflects that an area is legally open to snowmobiling, although the winter recreational opportunity spectrum mapping does not consider topography, access or consistent snow), there would be 8,884 fewer acres available for winter motorized recreation use compared to the current plans (table 186). Under this alternative, the applicable travel plans would need to be updated after completion of the forest plan revision process.

Table 186. Alternative C recommended wilderness area winter motorized available acres, change from the current plans

Recommended Wilderness Area	Geographic Area	Loss of acres for over-snow motorized opportunities
Lost Water Canyon	Pryor Mountains	0
Mystic	Absaroka Beartooth Mountains	0
Red Lodge Creek Hell Roaring	Absaroka Beartooth Mountains	0
Line Creek Plateau	Absaroka Beartooth Mountains	0
Republic Mountain	Absaroka Beartooth Mountains	0
Lionhead	Madison, Henrys Lake, Gallatin Mountains	0
Cowboy Heaven	Madison, Henrys Lake, Gallatin Mountains	0
Gallatin	Madison, Henrys Lake, Gallatin Mountains	2,060
Taylor Hilgard	Madison, Henrys Lake, Gallatin Mountains	6,824
Total Acres	No Data	8,884

Under alternative C, operating the Windy Pass rental cabin as a developed site would continue. In 2015, the Windy Pass cabin was rented 93 percent of the days it was available, the highest utilization rate of all 27 rental cabins and lookouts on the Custer Gallatin. This indicates that during the 120 day operating season there would likely be fairly constant visitor activity in that cabin location. Buffalo Horn administrative cabin, a historic structure in use administratively in the Gallatin Recommended Wilderness Area, may be allowed to remain within this recommended wilderness area, but would need to undergo separate evaluation to determine the appropriateness of retaining such a structure. There are no current recreation event special use permits located within recommended wilderness areas in alternative C.

Commercial communication sites such as cell phone towers would not suitable in recommended wilderness areas and a process would start for the eventual removal of such structures operating under special use permit. In addition to the communication sites of alternative B, alternative C has another commercial communication use at Sheep Mountain. Under plan components, the commercial uses would be phased out or moved outside of the recommended wilderness area within the lifetime of the plan. The Forest Service would be able to continue operation of the repeater site on Eaglehead; however, the other communication uses by partner agencies would need to be evaluated for their administrative necessity (for example, search and rescue) in order to remain. The two commercial sites, in order to meet suitability components, would need to be moved outside of recommended wilderness area or phased out over time with consequent impacts to the holder.

Table 187 below displays the acres of outstanding mineral rights, reserved mineral rights, oil and gas leases and whether there are mining claims within recommended wilderness areas proposed in alternative C. Reasonable access and other mineral activities may occur in areas with mineral encumbrances, even if plan components for recommended wilderness state that no new roads or structures could be constructed.

Under this alternative C, there are 6,804 recommended wilderness area acres in the Pryor Mountains or nine percent of the total geographic area. There are a total of 2,238 recommended wilderness area acres in the Absaroka Beartooth Mountains Geographic Area or less than half of a percent of that total geographic area. Finally, there are 137,513 acres or about seventeen percent within recommended wilderness area in the Madison, Henrys Lake, and Gallatin Mountains Geographic Area.

Table 187. Alternative C recommended wilderness area (RWA) acres and presence of mineral encumbrances

Recommended Wilderness Area	RWA Acres	Acres Outstanding Mineral Rights	Acres Reserved Mineral Rights	Acres Oil and Gas Leases	Mining Claims Present
Lost Water Canyon	6,804	0	0	none	No
Mystic	247	0	0	none	No
Red Lodge Creek Hell Roaring	802	0	0	none	No
Line Creek Plateau	801	0	0	none	No
Republic Mountain	388	0	0	none	No
Lionhead	15,738	0	0	none	No
Cowboy Heaven	15,536	1,770	0	none	No
Gallatin	99,415	2,619	13,069	479	No
Taylor Hilgard	6,824	0	0	none	No
Total Acres	146,555	4,389	13,069	479	0

Table 188 summarizes the effects of recommended wilderness area in alternative C.

Table 188. Recommended wilderness area indicators for Alternative C

Indicators	Unit of Measure
Acres and percent of total NF within recommended wilderness	146,555 acres; 4.8%
Acres and percent of inventoried roadless area within recommended wilderness	142,574 acres; 97%;
Acres no longer available for motorized over-snow vehicle use in recommended wilderness	8,884 acres
Miles of trail no longer available to recreational wheeled motorized use in recommended wilderness	0 miles
Miles of trails no longer available for mechanized transport in recommended wilderness	14 miles
Existing special use permits or facilities	Windy Pass rental cabin, Buffalo Horn admin cabin, Steamboat Mountain, Twin Peaks, Eaglehead, Sheep Mtn. communication uses

Alternative D

Management Direction under Alternative D

Thirty-nine areas are recommended as wilderness for a total of 711,425 acres. The 3,917 acres in the current Custer Forest Plan’s Burnt Mountain Recommended Wilderness Area not included in alternatives A, B and C are now incorporated within the 12,039 acres of Red Lodge Creek Recommended Wilderness Area. All recommended wilderness areas included in alternatives B and C are among the thirty-nine areas included in this alternative, although boundary configurations may change from those alternatives.

Eighty-eight percent of recommended wilderness areas in alternative D are also within inventoried roadless areas. Table 189 displays the recommended wilderness areas in alternative D, their acreage and the geographic areas in which they are located, as well as recommended wilderness area acres within inventoried roadless areas.

Table 189. Alternative D recommended wilderness area acres by geographic area, total acres and inventory roadless area acres

Name	Geographic Area	RWA Acres	RWA acres in Inventoried Roadless Area	Percent of RWA in IRA
Cook Mountain	Ashland	9,794	9,592	98%
King Mountain	Ashland	10,502	10,348	99%
Tongue River Breaks	Ashland	16,883	16,818	99%
Bear Canyon	Pryor Mountains	10,366	0	0%
Big Pryor	Pryor Mountains	12,737	0	0%
Lost Water Canyon	Pryor Mountains	12,992	10,199	79%
Punch Bowl	Pryor Mountains	7,766	0	0%
Chico Peak	Absaroka Beartooth Mountains	7,036	6,973	99%
Deckard Flats	Absaroka Beartooth Mountains	935	905	97%

Name	Geographic Area	RWA Acres	RWA acres in Inventoried Roadless Area	Percent of RWA in IRA
Deer Creek	Absaroka Beartooth Mountains	85,444	76,123	89%
Dome Mountain	Absaroka Beartooth Mountains	9,540	7,287	76%
East Rosebud to Stillwater	Absaroka Beartooth Mountains	17,422	14,088	81%
Emigrant Peak	Absaroka Beartooth Mountains	15,829	11,550	73%
Knowles Peak	Absaroka Beartooth Mountains	1,223	1,182	97%
Line Creek Plateau	Absaroka Beartooth Mountains	26,605	23,670	89%
Mount Rae	Absaroka Beartooth Mountains	2,839	2,815	99%
Mystic	Absaroka Beartooth Mountains	136	114	84%
North Fork	Absaroka Beartooth Mountains	36	0	0%
Phelps Creek	Absaroka Beartooth Mountains	3,177	3,171	99%
Red Lodge Creek	Absaroka Beartooth Mountains	12,039	7,975	66%
Republic	Absaroka Beartooth Mountains	388	388	100%
Sheep Creek	Absaroka Beartooth Mountains	557	543	97%
Strawberry Creek	Absaroka Beartooth Mountains	11,597	11,419	98%
Tie Creek	Absaroka Beartooth Mountains	5,886	5,181	88%
West Fork Rock Creek	Absaroka Beartooth Mountains	12,470	12,451	99%
West Woodbine	Absaroka Beartooth Mountains	1,091	1,020	94%
Blacktail Peak	Bridger, Bangtail, Crazy Mountains	6,147	6,131	99%
Crazy Mountains	Bridger, Bangtail, Crazy Mountains	59,636	59,146	99%
West Bridger	Bridger, Bangtail, Crazy Mountains	26,106	24,897	95%
Buck Creek	Madison, Henrys Lake, Gallatin Mountains	28,966	27,718	96%
Cabin Creek North	Madison, Henrys Lake, Gallatin Mountains	17,092	17,013	99%
Cabin Creek South	Madison, Henrys Lake, Gallatin Mountains	19,272	17,986	93%
Cowboy Heaven	Madison, Henrys Lake, Gallatin Mountains	14,357	14,310	99%
Gallatin	Madison, Henrys Lake, Gallatin Mountains	193,709	175,520	91%
Lionhead	Madison, Henrys Lake, Gallatin Mountains	31,389	29,356	94%
Spanish Peaks East	Madison, Henrys Lake, Gallatin Mountains	5,861	5,660	97%
Spanish Peaks South	Madison, Henrys Lake, Gallatin Mountains	2,845	2,808	99%
Taylor Hilgard	Madison, Henrys Lake, Gallatin Mountains	4,466	4,465	100%
Yankee Jim Lake	Madison, Henrys Lake, Gallatin Mountains	6,292	3,701	59%
Total Acres	No data	711,425	622,524	88%

RWA is recommended wilderness; IRA is inventory roadless area

Under alternative D, motorized and mechanized recreation uses (such as, mountain bikes), including motorized winter over-snow use, and continued use of commercial communication sites are not suitable within recommended wilderness areas. Administrative use of mechanical or motorized equipment is allowed to accomplish restoration activities and maintenance of trails. Recommended wilderness areas are not suitable for developed recreation sites, and so use of the Windy Pass Cabin as a recreation rental cabin would no longer continue. All recommended wilderness areas would be managed as primitive recreational opportunity spectrum. Primitive recreational opportunity spectrum desired condition, trails, signs, and infrastructure would be managed to a lower condition than currently exists. This would result, for example, in a setting managed to feature for challenge, self-reliance, and route-finding experiences, compared to one of managing for visitor safety, ease, and comfort. There are 41,364 acres within recommended wilderness area also managed as a key linkage areas for wildlife connectivity under alternative D.

Effects of Alternative D

Alternative D has the largest number of acres within recommended wilderness area at 711,425 acres or more than 23 percent of the Custer Gallatin National Forest. This increases by 678,011 acres compared to the current plans. Based on semi-primitive- motorized winter recreational opportunity spectrum mapping (which reflects that an area is legally open to snowmobiling, although the winter recreational opportunity spectrum mapping does not consider topography, access or consistent snow), there would be 234,621 acres fewer acres available for winter motorized recreation use compared to the current plans (table 190). The displacement effect on winter motorized use is difficult to predict. Winter motorized recreationists may seek out other locations on this forest, or find opportunities on other public lands. For winter recreationists seeking areas without needing to share lands with motorized uses, this would conversely increase those opportunities.

Table 190. Recommended wilderness area winter motorized suitable acres –change from the current plans

Recommended Wilderness Area	Geographic Area	Loss of Acres for Over-snow Motorized Opportunities
Cook Mountain	Ashland	0
King Mountain	Ashland	0
Tongue River Breaks	Ashland	0
Bear Canyon	Pryor Mountains	3,936
Big Pryor	Pryor Mountains	9,376
Lost Water Canyon	Pryor Mountains	4,448
Punch Bowl	Pryor Mountains	4,106
Chico Peak	Absaroka Beartooth Mountains	7,036
Deckard Flats	Absaroka Beartooth Mountains	81
Deer Creek	Absaroka Beartooth Mountains	62,477
Dome Mountain	Absaroka Beartooth Mountains	51
East Rosebud to Stillwater	Absaroka Beartooth Mountains	695
Emigrant Peak	Absaroka Beartooth Mountains	4,856
Knowles Peak	Absaroka Beartooth Mountains	1,223
Line Creek Plateau	Absaroka Beartooth Mountains	0
Mount Rae	Absaroka Beartooth Mountains	2,839
Mystic	Absaroka Beartooth Mountains	0

Recommended Wilderness Area	Geographic Area	Loss of Acres for Over-snow Motorized Opportunities
North Fork	Absaroka Beartooth Mountains	0
Phelps Creek	Absaroka Beartooth Mountains	317
Red Lodge Creek	Absaroka Beartooth Mountains	390
Republic	Absaroka Beartooth Mountains	0
Sheep Creek	Absaroka Beartooth Mountains	557
Strawberry Creek	Absaroka Beartooth Mountains	11,597
Tie Creek	Absaroka Beartooth Mountains	5,790
West Fork Rock Creek	Absaroka Beartooth Mountains	0
West Woodbine	Absaroka Beartooth Mountains	1,091
Blacktail Peak	Bridger, Bangtail, Crazy Mountains	6,147
Crazy Mountains	Bridger, Bangtail, Crazy Mountains	8,701
West Bridger	Bridger, Bangtail, Crazy Mountains	23,988
Buck Creek	Madison, Henrys Lake, Gallatin Mountains	11,547
Cabin Creek North	Madison, Henrys Lake, Gallatin Mountains	7,972
Cabin Creek South	Madison, Henrys Lake, Gallatin Mountains	17,794
Cowboy Heaven	Madison, Henrys Lake, Gallatin Mountains	0
Gallatin	Madison, Henrys Lake, Gallatin Mountains	24,927
Lionhead	Madison, Henrys Lake, Gallatin Mountains	6,240
Spanish Peaks East	Madison, Henrys Lake, Gallatin Mountains	0
Spanish Peaks South	Madison, Henrys Lake, Gallatin Mountains	230
Taylor Hilgard	Madison, Henrys Lake, Gallatin Mountains	4,466
Yankee Jim Lake	Madison, Henrys Lake, Gallatin Mountains	107
Total acres	(No Data)	232,985

The total motorized and mechanized trails affected is larger than other alternatives. Table 191 displays the recommended wilderness areas and the trails no longer suitable for motorized and mechanized recreation use. Those recreationist who use the existing trails that would no longer be available for the modes of travel they seek would be displaced. It is not possible to predict the locations where users would ride instead. They may ride elsewhere on the Custer Gallatin or seek other opportunities on public lands. Alternative D has the largest amount of closures to current motorized and mechanized recreational uses on trails within recommended wilderness area. Under this alternative, the applicable travel plans would need to be updated after completion of the forest plan revision process.

Table 191. Miles of motorized and mechanized recreation trails in recommended wilderness area under Alternative D

Recommended Wilderness Area	Geographic Area	All Motorized Vehicles and Bicycles	ATVs and Bicycles	Bicycles	Motor-cycles and Bicycles
Cook Mountain	Ashland	0	0	0	0
King Mountain	Ashland	0	0	0	0
Tongue River Breaks	Ashland	0	0	0	0

Recommended Wilderness Area	Geographic Area	All Motorized Vehicles and Bicycles	ATVs and Bicycles	Bicycles	Motor-cycles and Bicycles
Bear Canyon	Pryor Mountains	0	0	0	0
Big Pryor	Pryor Mountains	4.78	0	5.73	0
Lost Water Canyon	Pryor Mountains	0	0	0	0
Punch Bowl	Pryor Mountains	0	0	0	0
Total	**Pryor Mountains**	**4.78**	**0**	**5.73**	**0**
Chico Peak	Absaroka Beartooth Mountains	0	0	0	0
Deckard Flats	Absaroka Beartooth Mountains	0	0	0	0
Deer Creek	Absaroka Beartooth Mountains	0	6.78	35.65	45.46
Dome Mountain	Absaroka Beartooth Mountains	0	0	4.52	0
East Rosebud to Stillwater	Absaroka Beartooth Mountains	0	0	2.11	0
Emigrant Peak	Absaroka Beartooth Mountains	0	0	4.86	0
Knowles Peak	Absaroka Beartooth Mountains	0	0	2.08	0
Line Creek Plateau	Absaroka Beartooth Mountains	0	0	26.02	0
Mount Rae	Absaroka Beartooth Mountains	0	0	0.69	0
Mystic	Absaroka Beartooth Mountains	0	0	0	0
North Fork	Absaroka Beartooth Mountains	0	0	0	0
Phelps Creek	Absaroka Beartooth Mountains	0	0	0.70	0
Red Lodge Creek	Absaroka Beartooth Mountains	0	0	1.95	0
Republic	Absaroka Beartooth Mountains	0	0	0	0
Sheep Creek	Absaroka Beartooth Mountains	0	0	0	0
Strawberry Creek	Absaroka Beartooth Mountains	0	0	2.88	0
Tie Creek	Absaroka Beartooth Mountains	0	0	0	0
West Fork Rock Creek	Absaroka Beartooth Mountains	0	0	9.99	0
West Woodbine	Absaroka Beartooth Mountains	0	0	0	0
Total	**Absaroka Beartooth Mountains**	**0**	**6.78**	**91.45**	**45.46**
Blacktail Peak	Bridger, Bangtail, Crazy Mountains	0	0	0	0
Crazy Mountains	Bridger, Bangtail, Crazy Mountains	0	0	13.37	4.50
West Bridger	Bridger, Bangtail, Crazy Mountains	0	0.61	22.62	25.62
Total	**Bridger, Bangtail, Crazy Mountains**	**0**	**0.61**	**37.19**	**30.12**
Buck Creek	Madison, Henrys Lake, Gallatin Mountains	0	9.14	22.13	10.58
Cabin Creek North	Madison, Henrys Lake, Gallatin Mountains	0	3.54	6.89	0
Cabin Creek South	Madison, Henrys Lake, Gallatin Mountains	0	0.76	9.64	3.49
Cowboy Heaven	Madison, Henrys Lake, Gallatin Mountains	0	0	4.97	0
Gallatin	Madison, Henrys Lake, Gallatin Mountains	0	10.69	46.14	40.65

Recommended Wilderness Area	Geographic Area	All Motorized Vehicles and Bicycles	ATVs and Bicycles	Bicycles	Motor-cycles and Bicycles
Lionhead	Madison, Henrys Lake, Gallatin Mountains	0	5.22	29.55	0
Spanish Peaks East	Madison, Henrys Lake, Gallatin Mountains	0	0	0	0
Spanish Peaks South	Madison, Henrys Lake, Gallatin Mountains	0	0	1.62	0
Taylor Hilgard	Madison, Henrys Lake, Gallatin Mountains	0	0	0	0
Yankee Jim Lake	Madison, Henrys Lake, Gallatin Mountains	0	0	1.45	0
Total	**Madison, Henrys Lake, Gallatin Mountains**	**0**	**29.34**	**122.37**	**55.26**
Total Miles	**No Data**	**4.8**	**36.7**	**255.6**	**130.3**

Under alternative D, three rental cabins in recommended wilderness area would be discontinued. In 2015 the Yellow Mule cabin was rented 25 percent, Deer Creek cabin 15 percent, and Windy Pass cabin 93 percent of available days; demonstrating the relative desirability of these cabin rentals to the public. Closing these three cabins still provides 24 other rental cabin locations across the Custer Gallatin. As with alternatives B and C, Buffalo Horn administrative cabin, a historic structure in use administratively in the Gallatin recommended wilderness area may be allowed to remain, but would need to undergo separate evaluation to determine the appropriateness of retaining such a structure. The Cinnamon Lookout is a historic structure, no longer used for fire detection, which hosts a communication site which would be separately evaluated to determine the appropriateness of it to remain in a recommended wilderness area.

Recreation events are typically large public gatherings on the national forest where a fee is charged by organizers, and managed under special use permits. These events are prohibited in designated wilderness. All alternatives state that new recreation event special use permits are prohibited in recommended wilderness areas. Under alternative D, multiple special use permits for recreation events have been issued as of 2018 for ongoing events on the Custer Gallatin, which take place within a recommended wilderness area, as listed below:

- The Bozeman Ice Festival (partly), an international attraction
- Tour de Hyalite the foot race portion which goes to Hyalite Peak
- Jim Bridger summer foot race
- Baldy Blitz foot race
- Old Gabe foot race
- Bridger Ridge Run, a national attraction
- Foothills foot race

Those events with a multi-year permit at the time the plan is signed would be allowed to finish out their permits, however new ones would not be issued. These events would need to seek other locations, as recreation events are not appropriate in areas managed to promote wilderness characteristics. Finding remaining ridge routes for foot races outside of designated wilderness or recommended wilderness areas may be difficult under this alternative.

Five special use permitted communication sites are included in recommended wilderness area in this alternative. Buck Ridge; Steamboat Mountain; Eaglehead, Sheep, and Twin Peaks sites would be evaluated to determine if they could remain in recommended wilderness areas. Eaglehead may be separately evaluated as it is also administratively used and might remain. A special use permitted water line runs about 1/3 mile in the West Bridger Recommended Wilderness. This waterline would be evaluated to determine if methods used for ongoing operation and maintenance would need to change to comply with Recommended Wilderness Area components.

Under alternative D, the Lost Water Canyon recommended wilderness would overlap the Pryor Mountain Wild Horse Territory on 4,311 acres. The area of overlap appears generally modified from wild horse grazing (low to moderate similarity to reference conditions) and some areas are not naturally appearing. The Pryor Mountain Wild Horse Territory north boundary fence (around 1.5 miles) is found close to the recommended wilderness area. Motorized use is limited to the designated Burnt Timber Road #2849 which bisects the recommended wilderness area under alternative D. Ongoing road management, traditional uses, and wild horse administration would create difficult manageability issues within the wild horse territory management in this area. Routine wild horse management needs include activities such as population counts, immuno-contraception darting, bait trapping, periodic gathers, infrastructure maintenance, research activities, and weed treatment. Administrative motorized and aerial uses occur routinely. Under alternative D, these routine wild horse management activities aided by motorized, mechanized, or aerial means would not be allowed on 98 percent of the wild horse territory (4,311 acres). Alternative D would also substantially reduce the amount of area (about two percent of the territory), where commercial permits (for example, commercial filming) could be conducted including wild horse commercial filming. Managing this small area for wilderness character would be difficult with the routine administrative activities used to management wild horses.

Table 192 displays the acres of outstanding mineral rights, reserved mineral rights, oil and gas leases, and whether there are mining claims within recommended wilderness areas proposed in alternative D. Reasonable access and other mineral activities may occur in areas with mineral encumbrances, even if plan components for recommended wilderness state that no new roads or structures could be constructed.

Table 192. Alternative D recommended wilderness acres and presence of mineral encumbrances

Recommended Wilderness Area	RWA Acres	Acres Outstanding Mineral Rights	Acres Reserved Mineral Rights	Acres Oil and Gas Leases	Mining Claims Present
Cook Mountain	9,794	1,405	0	none	No
King Mountain	10,502	142	142	none	No
Tongue River Breaks	16,883	0	0	none	No
Bear Canyon	10,366	0	0	none	No
Big Pryor	12,737	0	0	none	No

Recommended Wilderness Area	RWA Acres	Acres Outstanding Mineral Rights	Acres Reserved Mineral Rights	Acres Oil and Gas Leases	Mining Claims Present
Lost Water Canyon	12,992	0	0	none	No
Punch Bowl	7,766	0	0	none	No
Chico Peak	7,036	0	0	none	Yes
Deckard Flats	935	0	32	none	No
Deer Creek	85,444	0	0	none	Yes
Dome Mountain	9,540	0	0	none	No
East Rosebud to Stillwater	17,422	0	0	0.22	Yes
Emigrant Peak	15,829	31	0	623	Yes
Knowles Peak	1,223	0	0	none	No
Line Creek Plateau	26,605	0	0	none	No
Mount Rae	2,839	0	0	none	Yes
Mystic	136	0	0	none	No
North Fork	36	0	0	none	No
Phelps Creek	3,177	0	0	none	No
Red Lodge Creek	12,039	0	671	none	No
Republic	388	0	0	none	No
Sheep Creek	557	0	0	none	No
Strawberry Creek	11,597	0	0	none	No
Tie Creek	5,886	0	0	none	No
West Fork Rock Creek	12,470	0	0	none	No
West Woodbine	1,091	0	0	none	Yes
Blacktail Peak	6,147	0	0	6,150	No
Crazy Mountains	59,636	9,974	634	none	No
West Bridger	26,106	81	0	15,862	No
Buck Creek (Ridge)	28,966	3,372	0	360	No
Cabin Creek North	17,092	1,912	0	none	No
Cabin Creek South	19,272	0	0	none	No
Cowboy Heaven	14,357	1,930	0	none	No
Gallatin	193,709	11,839	17,245	5,385	No
Lionhead	31,389	0	0	none	No
Spanish Peaks East	5,861	617	0	none	No
Spanish Peaks South	2,845	0	0	120	No
Taylor Hilgard	4,466	0	0	none	No
Yankee Jim Lake	6,292	1,370	0	none	No
Total Acres	711,425	32,673	18,724	28,500.22	6 RWAs have claims

RWA is recommended wilderness area

Table 193 summarizes the effects of recommended wilderness area in alternative D.

Table 193. Recommended wilderness area indicators for alternative D

Indicators	Alt D Unit of Measure
Acres and percent of total national forest within recommended wilderness areas	711,425 acres; 23.4%
Acres and percent of inventoried roadless area within recommended wilderness	622,524 acres; 88%
Acres no longer available for motorized over-snow vehicle use in recommended wilderness	232,984 acres
Miles of trails no longer available for wheeled motorized use and mechanized use in recommended wilderness	171.8 miles
Miles of non-motorized trails no longer open to mechanized transport in recommended wilderness	256.6 miles
Existing special use permits or facilities	Yellow Mule, Deer Creek and Windy Pass rental cabins. Cinnamon Lookout, Special use permit water line=0.36 miles

Alternative E

Management Direction under Alternative E

Under alternative E there would be no areas of recommended wilderness. Under alternative E all of the acres of potential recommended wilderness areas listed in other alternatives would be managed under other land allocations or forestwide direction.

Effects of Alternative E

There would be no change to the existing suitable uses of mechanized trails, wheeled motorized trails, motorized over-snow vehicle trails or areas, hiking and stock trails, or commercial communication uses as result of a recommended wilderness land allocation. Other land allocations may affect suitable uses in alternative E.

Consequences to Recommended Wilderness Areas from Forest Plan Components Associated with Other Resource Programs or Management Activities

Effects from Vegetation Management

Recommended wilderness areas are characterized by a natural environment where ecological processes such as natural succession, wildland fire, avalanches, insects, and disease function with a limited amount of human influence. In the current plans, under the Custer Forest Plan, prescribed fire for use in restoration is prohibited. However, in the revised plan alternatives, recommended wilderness is suitable for restoration activities where the outcomes will protect the wilderness characteristics of the areas as long as the ecological and social characteristics that provide the basis for each area's suitability for wilderness recommendation are maintained and protected. Restoration activities could include restoration of whitebark pine (currently a candidate species under the Endangered Species Act), which could consist of prescribed burning, seeding, planting of rust-resistant whitebark pine seedlings, thinning with an emphasis on hand thinning over mechanical, and protecting phenotypically superior seed-producing whitebark pine trees from loss due to fire, bark beetles, or other stressors. Control of invasive plant species (by hand pulling and herbicide spraying) and the planting or seeding of native plant species could also occur. Vegetation management activities conducted under the revised plan alternative vegetation plan components intended to promote ecological diversity, resilience and sustainability, could enhance the resilience of recommended wilderness areas.

Effects from Fire and Fuel Management

The revised plan alternatives allow wildland fire to be used if needed as a restoration tool, something prohibited in the 1986 Custer Forest Plan. This enhances the options for restoration of recommended wilderness areas. Wildland fire is managed to play its natural role while managers evaluate point protection of values at risk. Fuel treatments such as hand thinning may occur, especially in the wildland urban interface. Fire and fuels management plan components also specify the use of minimum impact strategies and tactics to manage wildland fire within recommended wilderness, which would further protect wilderness characteristics. Some wildland fires may be actively suppressed, based on factors evaluated at the time. However, when natural fires are suppressed in fire adapted ecosystems, there could be detrimental effects to ecosystem processes, wildlife habitat and biodiversity (Keane et al. 2002).

Effects from Watershed, Riparian, and Aquatic Management

The revised plan alternatives plan components and management activities for aquatic ecosystems would have little effect related to the overall management within recommended wilderness areas. The plan components that may have the greatest influence are those associated with riparian management zones in the revised plan alternatives. Little to no active management would occur in recommended wilderness areas; however, protection of riparian management zones could include relocating camp areas if impacts were occurring. Riparian management zones guidance allowing wildland fire in the inner riparian management zone to maintain or aquatic and riparian-associated resources may be complementary with maintaining ecological conditions in recommended wilderness areas.

Effects from Wildlife Management

Under alternative D only, the effect of having 41,364 acres of recommended wilderness area also managed as a key linkage area for wildlife connectivity may affect potential new trails. Wildlife plan components would have new trail construction restricted, unless needed to address ongoing or imminent resource issues within the key linkage area. Re-routed segments to existing trails to mitigate resource damage would be allowed. Trail changes to provide for increased visitor capacity alone, would not be authorized.

Effects from Scenery Management

Recommended wilderness areas are assigned a scenery integrity objective of very high. Because management activities within recommended wilderness areas would be designed to maintain wilderness characteristics, the scenic integrity objective of very high would be compatible with that direction and would have no negative impacts on the potential future designation of these areas.

Effects from Permitted Livestock Grazing Management

The plan components for the revised plan alternatives do not allow for new or expanded livestock grazing allotments to occur within recommended wilderness areas; however, existing allotments may be retained. Therefore, the plan components that guide livestock grazing and management would influence recommended wilderness areas. While livestock grazing itself has the potential to degrade plant communities through factors such as invasive plant spread and damage to riparian areas, plan components emphasize the maintenance of resilient native plant communities as well as desirable riparian area conditions.

Cumulative Effects

In general, cumulative effects are the past, present, and reasonably foreseeable future effects from management activities on the Custer Gallatin and adjacent lands. Reasonable and foreseeable future actions on National Forest System lands include vegetation management, mining, and reduction of fuels in the wildland urban interface. These actions could impact the wilderness characteristics of solitude, depending on how close and pervasive these actions were, although typically just the sights and sounds within the recommended wilderness area are used to determine effects on wilderness characteristics. For example, vegetation management activities such as harvesting adjacent to a recommended wilderness area might increase the sights and sounds of logging equipment such as chainsaws and skidders within the recommended wilderness area, but because the harvesting is being done outside of the recommended wilderness area, it would not be considered as degrading the wilderness characteristic of solitude. However, in another example, an expansion of a ski area adjacent to recommended wilderness could increase use levels within the recommended wilderness, which might affect solitude as the number of encounters with others could increase within the recommended wilderness area.

Growth in the western counties near the Custer Gallatin and the Billings area is likely to increase recreational use of the national forest, including use within recommended wilderness areas. The effects of urbanization and population growth on recommended wilderness use and resource conditions are likely to be gradual and to extend well beyond the planning period. Increased recreational use may negatively affect wilderness characteristics, particularly the opportunity for solitude and natural quality. Examples of potential impacts include increased opportunity for crowding in certain locations, soil compaction or erosion, and threats to native plant species from the spread of noxious weeds from sources outside the area.

Conclusion

In addition to plan components to maintain the characteristics of the recommended wilderness areas, Forest Service policy and regulations would provide additional direction for management.

Alternatives D, C, B, the current plans, and alternative E, in that order, contain the most to the least areas recommended for wilderness. Alternatives D and C in that order result in the most potential displacement of current trail users, who would no longer be able to use motorized or mechanized modes of travel. The current plans alternatives B, and E would not affect current uses. Alternatives vary with the amount of recommended wilderness that is also within inventoried roadless areas. The alternatives with most to least recommended wilderness area inside inventory roadless areas are the current plans, and then alternatives B, C, D, and E.

3.22.3 Eligible Wild and Scenic Rivers

Affected Environment (Existing Condition)

The 2012 Forest Planning Rule requires all forests undergoing a plan revision to conduct a study to determine if rivers have certain characteristics that would allow them to be eligible as a wild, scenic, or recreational river under the 1968 Wild and Scenic Rivers Act. Following the planning protocols, a study was conducted on all named rivers on the Custer Gallatin National Forest. They were evaluated by a forest interdisciplinary study, followed by public review and comments, to determine if they meet the criteria to be determined eligible under the Wild and Scenic Rivers Act. Prior to this current river study, both the 1986 and 1987 forest plans had earlier determined eligible rivers and plan components for their management and protection. Those rivers were again included in the new eligibility study as some guidance had changed. Eligibility is based on the study's determination that the rivers segments are free-flowing and possess one or more outstandingly remarkable value (ORVs). Those ORVs that are evaluated are fisheries, wildlife, recreation, geology, scenery, and historic or cultural values. Appendix E of the proposed action provides more information on the river eligibility study. Subsequent to the proposed action, one modification was made to the classification of Crooked Creek #182. Where the creek enters National Forest System lands (from the southern boundary with the Bureau of Land Management), that segment is now potentially classified as wild, until it meets the ½ mile buffer with Cave Creek; it had been potentially classified as scenic. At that junction near Cave Creek, the reminder of the Crooked Creek segment is potentially classified as scenic.

Only Congress can pass legislation that, once signed by the president, would designate a river. This designation occurred in August of 2018 for the East Rosebud Creek, which is no longer considered an eligible river and therefore has been removed from this section.

Once identified, a corridor of ¼ mile on either side of the eligible river or river segment is identified for the protection and management of the wild and scenic river (WSR) related values. For management purposes, identified eligible WSR segments are tentatively classified as wild, scenic, or recreational.

- Wild: Those rivers or sections of rivers that are free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted.
- Scenic: Those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads.
- Recreational: Those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

Environmental Consequences

Current Plans

Management Direction under the Current Plans

Plan components in both current plans, as amended, protect rivers found eligible so that ongoing management will not alter their eligibility if Congress decides to seek designation. Components protect the free-flowing nature, and assure that national direction and policy as stated in Forest Service manuals are followed.

The Custer National Forest Plan Amendment 2 listed seven eligible rivers. East Rosebud Creek has since been designated as a wild and scenic river. The six remaining eligible rivers are listed in table 194.

Table 194. Eligible rivers and potential classifications on the Custer National Forest*

River/Segment	Potential Classification	Miles	Outstandingly Remarkable Values
Crooked River-Lost Water Canyon	Wild	8	Cultural, Fisheries, Geologic, Scenic
Lake Fork Rock Creek: Outside of Wilderness Within the Wilderness	 Recreational Wild	 2 8	 Geologic, Scenic Geologic, Scenic
Rock Creek: Outside of Wilderness Within the Wilderness	 Recreational Wild	 13 3	 Geologic, Recreation Geologic, Recreation
Stillwater: Outside of Wilderness Within the Wilderness	 Recreational Wild	 7 20	 Fisheries, Recreation, Scenic Fisheries, Recreation, Scenic
West Fork Rock Creek: Outside of Wilderness Within the Wilderness	 Recreational Wild	 10 10	 Fisheries, Geologic, Recreation Fisheries, Geologic, Recreation
West Rosebud Creek: Within the Wilderness	 Wild	 8	 Geologic, Recreation, Scenic

*An additional river, the Little Missouri River, was also found eligible in Amendment #2, but this part of the forest area is now administered by the Dakota Prairie Grasslands, so is no longer included here

Five eligible rivers are listed in table 195 from the original 1987 Gallatin National Forest Plan and Plan Amendment 12. River miles written in the original plans have been now been found to be approximate, using updated GIS calculations.

Table 195. Eligible rivers from 1987 Gallatin National Forest Plan and Plan Amendment 12

River/Segment	Potential Classification	Miles	Outstandingly Remarkable Values
Boulder River; as amended Forest boundary to Blakely Creek and from Miller Creek to Bramble Creek	Recreational	9 Miles	Geologic, Recreation, Scenic
Blakely Creek to Miller Creek and from Bramble Creek to Wilderness Boundary	Scenic	19 Miles	Geologic, Recreation, Scenic
Clarks Fork of Yellowstone River Forest boundary upstream to bridge crossing at the Clarks Fork trailhead	Wild	Approx. 1.8 miles	Scenic
Gallatin River Forest boundary upstream to Yellowstone National Park boundary.	Recreational	39 river miles entire length	Fisheries, Recreation, Scenic
Madison River Forest boundary upstream to Hebgen Dam including Quake Lake.	Recreational	8	Geologic, Scenic, Fisheries
Yellowstone River Forest boundary upstream to Yellowstone National Park boundary	Recreational	17 river miles entire length	Recreation, Scenic

Effects of the Current Plans

Under all alternatives, the identified eligible wild and scenic rivers (and area within ¼ mile on either side of each rivers' high water mark) would be managed to protect their free-flowing condition and to preserve and enhance the outstandingly remarkable values for which they were identified. Fewer rivers were found eligible in the current plans than the revised plan alternatives.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

The rivers found to be eligible as a wild and scenic river do not change by any revised plan alternative. Plan components in all revised plan alternatives protect the rivers' free-flowing nature, preliminary classification and outstandingly remarkable values(s). Plan direction for topics such as timber production, wildfire, and fish barrier construction have been addressed in desired conditions, guidelines, goals, and suitability. In all alternatives, eligible segments with a preliminary classification as wild would not be available for saleable mineral material extraction.

Table 196. Eligible rivers found in the revision of the Custer Gallatin Forest Plan

River Name	River Number	Location	Eligible Prior Plan?	Outstandingly Remarkable Values[1]	Preliminary Classifications
Bark Cabin Creek	19	Gallatin Mountains	No	F	Wild
Bear Creek	32	Pryor Mountains	No	W	Scenic
Big Creek	46	Gallatin Mountains	No	F	Wild
Big Timber Creek	50	Crazy Mountains	No	R, S	Recreational
Boulder River	68	Absaroka Beartooth Mountains	Yes	R, S, G, H	Recreational
Cabin Creek	100	Madison Mountains	No	F	Scenic
Cave Creek	123	Pryor Mountains	No	G	Wild
Clarks Fork Yellowstone River	137	Absaroka Beartooth Mountains	Yes	S	Wild, Recreational
Crooked Creek	182	Pryor Mountains	Yes	G, S, H, F	Wild, Scenic
Gallatin River	323	Gallatin/Madison Mountains	Yes	R, S, H	Recreational
Hyalite Creek	395	Gallatin Mountains	No	R, S	Scenic
Lake Abundance Creek	419	Absaroka Beartooth Mountains	No	F	Wild
Lake Fork of Rock Creek	421	Absaroka Beartooth Mountains	Yes	R, S	Wild, Recreational
Lost Water Creek	471	Pryor Mountains	No	S, G, H	Wild
Madison River	475	Madison Mountains	Yes	R, G, S, H, W	Recreational
Maid of the Mist Creek	477	Gallatin Mountains	No	R, S	Scenic
Middle Fork Cabin Creek	502	Madison Mountains	No	F	Scenic

River Name	River Number	Location	Eligible Prior Plan?	Outstandingly Remarkable Values[1]	Preliminary Classifications
Pine Creek	626	Absaroka Beartooth Mountains	No	R, S	Wild, Recreational
Rock Creek	668	Absaroka Beartooth Mountains	Yes	R, H, S	Recreational
Rock Creek	665	Absaroka Beartooth Mountains	No	F	Wild
Shower Creek	719	Gallatin Mountains	No	R, S	Scenic
Slough Creek & unnamed tributaries	737	Absaroka Beartooth Mountains	No	F	Wild, Scenic
Stillwater River	818	Absaroka Beartooth Mountains	Yes	R, S	Wild, Recreational
West Boulder River	889	Absaroka Beartooth Mountains	No	R	Wild
West Fork Rock Creek	908	Absaroka Beartooth Mountains	Yes	H, S	Wild, Recreational
West Fork Stillwater River	909	Absaroka Beartooth Mountains	No	S	Wild
West Rosebud Creek	916	Absaroka Beartooth Mountains	Yes	S, R	Wild
Woodbine Creek	931	Absaroka Beartooth Mountains	No	R, S	Wild, Recreational
Wounded Man Creek	933	Absaroka Beartooth Mountains	No	F	Wild
Yellowstone River	940	Absaroka Beartooth Mountains/Gallatin Mountains	Yes	R, S, H	Recreational

1. Outstandingly remarkable value codes: F=Fisheries, G=Geology, H= Historic, R=Recreation, S=Scenery, W=Wildlife

Effects of all Revised Plan Alternatives

Under all revised plan alternatives, the identified and eligible wild and scenic rivers (and area within ¼ mile on either side of each river's high water mark) would be managed to protect their free-flowing condition and to preserve and enhance the outstandingly remarkable values for which they were identified, as well as protect the tentative classifications. As this river eligibility study does not apply to privately owned lands, there are no direct effects on those lands. Each river segment may have unique mixes of outstandingly remarkable values and tentative classifications and should be individually reviewed to understand allowable or restricted uses or projects.

Nineteen additional rivers were found eligible under this river study compared to the current plans. Some previously existing eligible rivers may have had a change in the segments classification, length or outstandingly remarkable values found. However, all previously determined eligible rivers were once again found eligible.

There would be approximately 433 total river miles and 138,560 total acres within the ½ mile corridor of each river. 38,080 of additional acres would be managed within eligible river corridors than there was in the past 30 years under the current plans.

Some of those new eligible river corridor lands are also within designated wilderness, where the increase protection of an eligible river is a minor addition to existing wilderness management. As protection or enhancement of listed outstandingly remarkable values for each river segment are called for (along with retaining the preliminary classification listed), eligible river corridors should remain in a similar or improved condition for the current and foreseeable future.

Consequences to Eligible Wild and Scenic Rivers from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Timber Management

In all alternatives, eligible wild classified rivers are not suitable for timber production. Timber harvest would be allowed when needed in association with a primitive recreation experience, to protect users, or to protect identified outstandingly remarkable values. Examples of such exceptions include activities to maintain trails or suppress wildfires. For eligible scenic and recreational rivers there are a range of vegetation management and timber harvest practices allowed, if these practices are designed to protect users, or protect, restore, or enhance the river environment, including the long-term scenic character.

Effects from Fire and Fuels Management

Both natural and management ignited fires could change the outstandingly remarkable values present in a river segment such as scenery or historic resources.

Current plans' fire suppression directions are a range of responses. To minimize resource damage, the revised plan alternatives fire and fuels plan components call for minimum impact suppression tactics in sensitive areas such as eligible wild and scenic rivers, which would reduce resource impacts from the suppression effort itself. Exceptions may occur when a more direct attack is needed to protect life, adjacent property, or to mitigate risks to responders.

Natural, unplanned ignitions and prescribed fires are used as tools to maintain ecological conditions within river corridors. These fire and fuels management components may be used so long as they maintain the outstandingly remarkable values and free-flowing nature of the identified rivers. In an eligible river segment, wildland fires managed to meet resource objectives may be used to restore or maintain outstandingly remarkable values. In the revised plan alternatives, plan components for fire and fuels management would encourage an appropriate management response to wildfires and provide opportunities for natural fire to promote and enhance the characteristics of these areas.

Effects from Watershed, Riparian, and Aquatic Management

The revised plan alternatives provide more detailed guidance than the current plans for protection of watersheds, riparian areas, and aquatic habitats. The revised plan alternatives include the adoption of riparian management zones, which are greater in size from the riparian zones currently identified for streams east of the Continental Divide. Plan components and activities related to watershed, riparian, or aquatic habitat improvements would have a protective effect to eligible wild and scenic rivers, as they would to all rivers on the Custer Gallatin. The area influenced by riparian plan components (up to 200, depending on the body of water) is a shorter distance than the ¼ mile area on either side of the high-water mark of the stream where wild and scenic components apply, but provide very detailed protection.

For hydro-electric power facilities, Forest Service identified eligible rivers are to be protected from new dam construction pending a suitability determination.

Effects from Wildlife and Fisheries Management

Plan components for all alternatives state that there must be protection of the free-flowing nature, no altering the preliminary classification, and protection of identified outstandingly remarkable values. Fisheries components should harmonize with: the wild segment's essentially primitive character, the scenic rivers largely undeveloped character, and the recreational segments identified river values. In doing so, these components address future construction of minor structures and vegetation management to protect and enhance wildlife and fish habitat. Any portion of a proposed wildlife or fisheries restoration or enhancement project that has the potential to affect the rivers' free-flowing character must be evaluated as a water resources project. For example, fish barriers would be evaluated as a water resource project to ensure free-flowing waters are not affected, but also that construction of the shoreline development does not affect the tentative classification.

Effects of Land Allocations

Where an eligible river segment is within another land allocation that has stricter components, those stricter management directions take precedence. This may occur when an eligible river segment is in wilderness areas, recommended wilderness areas, inventoried roadless areas, research natural areas, or other allocation.

Effects from Access and Recreation Management

In all alternatives, in order to provide an essentially primitive character, eligible segments classified as wild would not likely have any recreation development occur. In segments classified as scenic or recreational, recreation development would be allowed, but only when it would preserve the identified river values and retain classification.

In all alternatives eligible rivers that have a preliminary classification of wild would not allow roads to be built with the ½ mile river corridor. Rivers with a preliminary classification of scenic allow new roads and railroads to be permitted to parallel the river for short segments or bridge the river if such construction fully protects river values (including the river's free-flowing character). For both scenic and recreational rivers, bridge crossings and river access are allowed. New trail construction or aircraft landing strips must be compatible with and fully protect identified values. Recreational rivers allow new roads and railroads which are permitted to parallel the river if such construction fully protects river values (including the river's free-flowing character).

Effects from Energy and Minerals Management

In revised plan alternatives, eligible river segments with a preliminary classification as wild would not be available for saleable mineral material extraction; this use would be allowed in scenic and recreational classifications. In the current plans, saleable mineral material extraction is allowable within all eligible wild and scenic rivers corridors. In all alternatives, leasable and locatable mineral development is allowable within eligible wild and scenic rivers corridors. Potential impacts would be reduced by the current plans' guidance to minimize mineral activity impacts to eligible wild and scenic rivers, and by revised plan alternative direction that mineral and energy resource development consider other resource values. All alternatives provide direction that the land be returned to a productive capacity after mineral or energy activity.

Cumulative Effects

Cumulative effects are the potential impacts to wild and scenic rivers from the alternatives when combined with past, present, and reasonably foreseeable actions. The lands used as the regions of comparisons (in the eligibility study) form the geographic scope for evaluating cumulative effects. The region of comparison is a geographic area or areas that provides the basis for meaningful comparative analysis of potentially eligible rivers. The Forest Service may conclude that a single region of comparison can encompass the evaluation of outstanding remarkable values. Acknowledging the diversity across the Custer Gallatin National Forest, two separate regions of comparison, for all the outstandingly remarkable values, are being utilized for the west and east sides of the national forest.

There are currently 70 other eligible rivers within the regions of comparison; 64 on other national forests, and six under other Federal jurisdictions. Under the revised plan alternatives, adding the Custer Gallatin's 31 eligible rivers would be a 44 percent increase within the regions of comparison.

There are about 314 miles of other eligible rivers within the regions of comparison and 100,480 acres of land included within the half-mile management buffer surrounding those segments. The addition of 19 more eligible rivers on the Custer Gallatin would add approximately 119 miles.

An eligibility finding means that no dams may be built on these river segments, as they will remain free flowing. In the future if there are proposed actions such as construction of a dam, a further suitability study could be conducted on any river. Suitability studies are not being conducted as part plan revision.

Less than one percent of Montana's river miles are protected under the Wild and Scenic Rivers Act. The sections of four rivers currently protected are a 149-mile stretch of the Upper Missouri River, and 219 miles of the North, Middle and South Forks of the Flathead River, and East Rosebud Creek. Nationally, less than 0.25 percent or 12,734 miles of the country's river miles are protected under the wild and scenic designation.

Conclusion

The revised plan alternatives add 19 additional eligible rivers and 38,080 additional acres within the ½ mile river buffers compared to the current plans. Plan components for rivers managed as eligible for the national wild and scenic river system would protect the outstandingly remarkable values, keep the rivers free flowing, and maintain the assigned tentative classifications for each river segment.

3.22.4 Backcountry Areas

Affected Environment (Existing Condition)

Backcountry area is a forest plan land allocation. Backcountry areas are generally undeveloped or lightly developed, either are unroaded, or have few, primitive roads. Some have neither roads nor trails. Backcountry areas provide for more remote, semi-primitive recreation opportunities, both motorized and nonmotorized, depending on the area. Similar areas are described in the 1986 Custer Forest Plan as low development areas on the Ashland Ranger District.

Environmental Consequences

Table 197 below displays the backcountry areas, their acreage and percent in inventoried roadless areas in each alternative. In the current plans, these areas are termed low development areas.

Table 197. Backcountry areas acreage and percentage in inventory roadless areas (IRA) by alternative

Backcountry Area	Geographic Area	Alt. A Acres*	Alt. B Acres	Alt. C Acres	Alt. D Acres	Alt. E Acres	Acres in IRA	Percent in IRA
Chalk Buttes	Sioux	0	0	0	5,937	0	0	0%
Cook Mountain	Ashland	9,794	9,794	9,794	0	0	9,592	98%
King Mountain	Ashland	12,189	12,189	12,189	0	0	11,979	98%
Tongue River Breaks	Ashland	16,431	16,431	16,431	0	0	16,365	99%
Big Pryor	Pryor Mountains	0	12,610	12,610	0	0	Alt B = 0 Alt C = 0	Alt B= 0% Alt C= 0%
Bear Canyon	Pryor Mountains	0	10,682	10,682	0	0	Alt B = 0 Alt C = 0	Alt B= 0% Alt C= 0%
Punch Bowl	Pryor Mountains	0	6,097	6,097	0	0	Alt B = 0 Alt C = 0	Alt B= 0% Alt C= 0%
Bad Canyon	AB	0	18,722	18,722	0	0	4,989	27%
Crazy Mountains	Bridger, Bangtail, Crazy Mtns	0	0	83,368	0	0	73,583	88%
Blacktail Peak	Bridger, Bangtail, Crazy Mtns	0	0	6,151	0	0	6,136	99%
West Bridgers	Bridger, Bangtail, Crazy Mtns	0	0	26,106	0	0	24,897	95%
West Pine	Madison, Gallatin, Henrys Lake Mtns	0	0	22,619	0	0	17,401	77%
Buffalo Horn	Madison, Gallatin, Henrys Lake Mtns	0	21,539	28,126	0	144,060	Alt B = 21,368 Alt C = 27,878 Alt E = 143,089	Alt B= 99% Alt C= 99% Alt E= 99%
Cowboy Heaven	Madison, Gallatin, Henrys Lake Mtns	0	17,026	0	0	0	16,940	99%
Lionhead	Madison, Gallatin, Henrys Lake Mtns	0	0	0	0	29,206	29,189	99%
Total Acres	No data	38,414	125,090	252,896	5,397	173,266	No data	No data
Total Percent Acres in IRA	No data	99%	69%	76%	0%	99%	No data	No data

*Low development areas from 1986 Custer Forest Plan

Table 198 summaries the management direction for backcountry areas. In the current plans, these areas are termed low development areas. Table 199 displays more detail on motorized and mechanized recreation use in each backcountry area.

Table 198. Backcountry areas (BCAs) uses allowed by alternative

Uses Allowed Backcountry Areas*	Alt. A**	Alt. B	Alt. C	Alt. D	Alt. E
New permanent roads	No	No	No	No	No
New temporary roads where not within IRA	No	Yes	Yes No: Buffalo Horn, West Pine BCAs	Yes	Yes
Hiking, horse use	Yes	Yes	Yes	Yes	Yes
New hiking, horse trails	Yes	Yes	Yes	Yes	Yes
Mountain bike use	Yes	Yes No: Ashland, Bad Canyon BCAs	Yes No: Ashland, Pryors, Blacktail Peak	Yes	Yes
New mountain bike trails	No	Yes No: Ashland, Blacktail Peak, Bad Canyon BCAs	Yes No: Ashland, Pryors BCAs	Yes	Yes
Motorized use on existing motorized trails and areas	No	Yes: Buffalo Horn, Big Pryor	Yes: Crazies, West Bridgers, Buffalo Horn, Blacktail Peak (over-snow only)	Yes: Chalk Buttes	Yes: Buffalo Horn
New motorized use on existing trails	No	No	No	No	No Yes: Buffalo Horn SPM corridors
New developed recreation sites	Yes	No	No	No	No
New recreation events	Yes	Yes No: Buffalo Horn BCA	Yes No: Buffalo Horn, West Pine BCAs	Yes	Yes
New commercial communication sites	No	No	No	No	No
New energy or utility corridors	No	No	No	No	No
New saleable mineral removal for example, gravel	No	No	No	No	No
New special use permits compatible with BCA	Yes	Yes	Yes	Yes	Yes
Timber production on suitable lands	No	No	No	No	No
Timber harvest; for fuels reduction, restoration, habitat improvement	Yes	Yes	Yes No: Buffalo Horn, Pryors BCAs	Yes	Yes

*Subject to outstanding mineral rights

**Low development areas from 1986 Custer Forest Plan

Note: SPM= Semi Primitive Motorized recreation opportunity spectrum

Table 199. Backcountry areas suitable for motorized and mechanized recreational uses

Backcountry Area	Motorized Recreation Use on Existing Motorized Routes and Areas	New Motorized Recreation Use on Existing Routes, per ROS	Mechanized Recreation Use
Chalk Buttes	Yes	No	Yes
King Mountain	No	No	No
Cook Mountain	No	No	No
Tongue River Breaks	No	No	No
Big Pryor	Alt B: Yes Alt C:No (3.6 miles on route #2095a no longer available)	No	Alt B: Yes Alt C: No (4.1 miles of Big Pryor trail #30, 1.7 miles of Crater Ice Cave #31 and 3.6 miles route 2095a no longer available).
Bear Canyon	No	No	Alt B Yes Alt C No
Punch Bowl	No	No	Alt B Yes Alt C No
Bad Canyon	No	No	Alt B No Alt C Yes
Crazy Mountains	Yes	No	Yes
Blacktail Peak	Yes over-snow only	No	No
West Bridgers	Yes	No	Yes
West Pine	No	No	Yes
Buffalo Horn	Yes	No: Alt B,C Yes: Alt E	Yes
Cowboy Heaven	No	No	Yes
Lionhead	No	No	Yes

Current Plans

Management Direction under the Current Plans

In the current plans, there are no backcountry areas; however, the 1986 Custer Forest Plan designated three low development areas on the Ashland Ranger District which are similar enough in management to backcountry areas to compare here. The 1987 Gallatin Forest Plan does not have a management area similar to either backcountry or low development areas.

The 1986 Custer plan goal for King Mountain, Cook Mountains, and the Tongue River Breaks low development areas is to retain these areas in a near natural condition, remain roadless or in a low development setting so that human use leaves little permanent or long-lasting effects. Management seeks to rehabilitate areas that have been previously impacted by other resource activities and uses. The three low development areas cover 38,414 acres in the current plans and all but 478 acres (or 99 percent) of those acres are also within inventoried roadless areas. Therefore, management direction for inventoried roadless areas also applies to most of the low development areas.

Specific management direction states that recreation development will be limited to parking, sanitation, and horse holding and handling facilities. Nonmotorized trails may be built. Native American religious concerns will be taken into special account in management of the Tongue River Breaks. Livestock grazing may continue as well as motorized vehicles for administration of grazing systems. Construction and repair of structural range improvements and noxious weed control will also continue, however, temporary roads are not allowed. Structural range improvements may be constructed, but their impact on the roadless and cultural resource characteristics of the area must be minimized. Timber harvest will generally not occur. Sale of forest products not requiring roads is allowed as a wildlife enhancement tool, as is limited post and poles removal for recreation or range facilities. There are limited circumstances for new facility construction; prescribed fire is allowed.

Effects of the Current Plans

Under the current plans, the three low development areas are managed for a near natural, roadless, low development conditions so that human use leaves little permanent or long-lasting effect. The desired condition is also achieved by virtue of 99 percent of the low development areas are also in Inventoried roadless area and are subject to the limits of that allocation. Under the current plans, the total acres of the three areas covers nine percent of the Ashland Geographic Area.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

All of the revised plan alternatives share much of the same management direction for backcountry areas. Plan direction would keep these areas in a largely undeveloped condition, where natural processes play their role and human use leaves little permanent or long lasting evidence. Direction is that new permanent roads, utilities, commercial communication sites, developed recreation facilities and extraction of saleable mineral material would not be allowed. Backcountry areas are not suitable for timber production, but would allow timber harvest, except in the Buffalo Horn, Big Pryor, Bear Canyon, and Punchbowl backcountry areas in alternative C.

Much of the acreage within the proposed backcountry areas is also designated as inventoried roadless areas (table 197). This analysis assumes that there will be no changes to inventoried roadless area boundaries or direction for the life of the plan. Where allocations overlap, the more restrictive management direction will take precedence.

Backcountry areas might not allow uses that inventoried roadless would allow. For instance, inventoried roadless area direction alone does not restrict motorized or mechanized trails and some of the backcountry areas do restrict these uses. Conversely, where backcountry areas allow timber harvest and temporary road building, those activities would be limited by the roadless area conservation rule.

Plan components that vary between alternatives for the same backcountry area are displayed in table 198 and table 199 above and discussed below for each alternative.

Alternative B

Management Direction under Alternative B

There are nine backcountry areas described in this alternative, totaling 125,090 acres in four Geographic Areas. The Ashland Geographic Area backcountry areas, King Mountain, Cook Mountain, and Tongue River Breaks, are the same boundaries managed as low developments in the current plans. These areas are not suitable for motorized and mechanized recreation use. Grazing allotment use of motorized is authorized by permit. New facilities are more limited than in the current plans. The physical environment and visual setting of the Tongue River Breaks provide the qualities of spiritual reflection, renewal, and sanctuary. In this area, any spring development will avoid those traditionally used for cultural practices by area Tribes.

The Pryor Mountains Geographic Area has three backcountry areas, Big Pryor, Bear Canyon, and Punchbowl. In alternative B new motorized trails and recreation facilities are prohibited (the areas are not suitable for motorized recreation use), however mechanized, foot, and horse trails could be built.

The Bad Canyon Backcountry Area in the Absaroka Beartooth Geographic Area would not allow mountain bike use.

Two backcountry areas are in the Madisons, Gallatin, and Henrys Lake Geographic Area; the Buffalo Horn and Cowboy Heaven. The Cowboy Heaven Backcountry Area is only designated in alternative B and is suitable for nonmotorized and mechanized recreation use. The Buffalo Horn Backcountry Area (21,539 acres in alternative B) is suitable for winter and summer motorized and mechanized recreation use, however new recreation events are not allowed. Wilderness study area direction that is more restrictive than backcountry areas direction would be followed, unless Congress released the wilderness study area.

Effects of Alternative B

Alternative B has nine backcountry areas, totaling 125,090 acres; the third highest alternative. Six of these areas were not included in the current plans. Therefore, an additional 68,414 acres would be managed as backcountry areas under alternative B compared to the low development areas of the current plans.

The three backcountry areas in the Ashland Geographic Area comprise about 38,414 acres and cover about nine percent of the national forest lands in this 436,124 acre geographic area. The three backcountry areas in the Pryors Geographic Area total 29,389 acres (39 percent in this 75,067 acre geographic area). Bad Canyon Backcountry Area in the Absaroka Beartooth is 18,722 acres, (just over 1 percent of that geographic area). The Buffalo Horn and Cowboy Heaven in the Madison, Gallatin, and Henrys Lake Geographic Area total 38,565 acres (5 percent of the national forest lands in the 805,299-acre geographic area).

Of those total backcountry area acres, 81,232 (or 65 percent) are also within inventoried roadless areas and where land allocations overlap, the more restrictive guidance would apply.

Under alternative B, management of the Ashland Backcountry Area would be similar as in the current plans, except new recreation developments would not be allowed and recreational mechanized use would be prohibited. The current plans do not allow for motorized use and did not state that mechanized was prohibited, however no system trails exist in this area.

In the Pryor Mountains, the Punch Bowl Backcountry Area is 6,097 acres; the Big Pryor Backcountry Area is 12,610 acres; and the Bear Canyon Backcountry Area is 10,682 acres and are a change from the current plans. As none of the Punch Bowl, Big Pryors, or Bear Canyon Backcountry Areas are also within inventoried roadless areas, under alternative B there would be prohibition of road building that is not currently restricted; new recreation facilities would be prohibited, and new motorized recreational trails would not be allowed. In a change from the existing situation, these backcountry areas would not be suitable for timber production although timber harvest might be allowed for purposes such as fuels reduction, restoration, or wildlife habitat enhancement. Existing grazing use would continue.

In the Absaroka Beartooth Geographic Area, the Bad Canyon Backcountry Area would be managed as backcountry with no motorized or mountain bike use allowed in this alternative. Only 27 percent of the backcountry area is in inventoried roadless area. Therefore, alternative B would restrict new road construction and timber production on the 73 percent of the non-inventoried roadless area lands, which is a change from the current plans. Timber harvest may be allowed for purposes such as fuels reduction, restoration, or wildlife habitat enhancement across the entire backcountry area.

In the Madisons, Gallatin, Henrys Lake Geographic Area, the Cowboy Heaven Backcountry Area would be open to recreational mechanized bicycle use as well as other nonmotorized travel. Both the Cowboy Heaven and Buffalo Horn Backcountry Areas are not suitable for timber production as they are 99 percent inventoried roadless area. Timber harvest may be allowed for purposes such as fuels reduction, restoration, or wildlife habitat enhancement. The Buffalo Horn Backcountry Area also would not host new recreation events, therefore displacing those activities to other locations, either on or off the national forest.

There are no changes in motorized winter recreation opportunities between the current plans and alternative B.

Alternative C

Management Direction under Alternative C

Alternative C has twelve backcountry areas, consisting of 252,896 acres in five geographic areas. Of those acres, 192,820 (or 76 percent) are also inventoried roadless areas and those inventoried roadless area plan components will apply where there are overlapping allocations.

The Ashland Geographic Area backcountry areas are identical in number, acres, and management direction as in alternative B.

The Pryor Mountain Backcountry Areas are the same as alternative B, totaling 29,389 acres. Alternative C plan components that differ from alternative B include a standard that prohibits mechanized or motorized recreation use and new motorized and mechanized trails. In contrast to alternative B, timber harvest is not allowed in the Pryor Mountains Backcountry areas. None of the Pryor Mountains Backcountry Areas are also within inventoried roadless areas.

In the Absaroka Beartooth Geographic Area, the Bad Canyon Backcountry Area (18,722 acres) would be managed as backcountry with no motorized use allowed. However, unlike alternative B, mountain bike use would be allowed in this alternative. Only twenty-seven percent of the backcountry area (4,989 acres) is in inventoried roadless area.

The Bridgers, Bangtails, and Crazy Mountain Backcountry Areas (Blacktail Peak, Crazy Mountains, and West Bridger) are proposed only in alternative C. In the Blacktail Peak Backcountry Area, quiet nonmotorized opportunities are common and the area is not suitable for motorized or mechanized recreation. The Crazy Mountain and West Bridger Backcountry Areas would be suitable for motorized and nonmotorized recreation.

The Madison, Gallatin, Henrys Lake Geographic Area includes the Buffalo Horn and West Pine Backcountry Areas in alternative C. The Buffalo Horn Backcountry Area in alternative C is larger than alternative B at 28,126 acres and is suitable for winter and summer motorized and mechanized recreation use. As opposed to alternative B, in alternative C timber harvest would not be allowed in the Buffalo Horn backcountry area. Wilderness study area direction that is more restrictive than Backcountry Area direction would be followed, unless Congress released the wilderness study area. The West Pine Backcountry Area is 22,619 acres and is managed for quiet nonmotorized recreation and is suitable for both nonmotorized and mechanized recreation.

Effects of Alternative C

At 252,896 acres, this alternative has the largest number of backcountry areas and acres of all plan alternatives. Seventy-six percent of backcountry areas are also within inventoried roadless in alternative C, which means that where land allocations overlap, the more restrictive guidance would apply. Backcountry areas might not allow uses that inventoried roadless would allow. Inventoried roadless area direction does not restrict motorized or mechanized trails, but some backcountry areas would.

Effects of the Ashland Backcountry Areas would be the same as alternatives A and B.

The three backcountry areas in Pryor Mountains are the same as in alternative B. The plan components in alternative C differ from alternative B by not allowing timber harvest, which may limit some restoration projects requiring vegetation management. Alternative C would not be suitable for motorized and mechanized recreation use. Therefore, within the Big Pryor Backcountry Area, motorized or mechanized recreation use would no longer be available on about 3.6 miles of route 2095a. Mechanized recreation use would no longer be available on about four miles of the Big Pryor Trail 30 and almost two miles of the Crater Ice Cave Trail 31.

In the Absaroka Beartooth Geographic Area, mountain bike use would be allowed in the Bad Canyon Backcountry Area in this alternative, unlike alternative B. Only twenty-seven percent of the backcountry area (4,989 acres) is in inventoried roadless area.

In the Bridgers, Bangtails, and Crazy Mountain Backcountry Areas, the backcountry allocation is proposed only in this alternative C. The three backcountry areas total 115,625 acres, or 56 percent of the 205,025 acre Geographic Area. The Blacktail Peak Backcountry Area is 99 percent, Crazy Mountains Backcountry Area is 88 percent, and the West Bridger Backcountry Areas is 95 percent inventoried roadless area, which limits road building and timber harvest. The Crazy Mountain Backcountry Area would be suitable year-round for motorized and mechanized use. The Blacktail Peak and West Bridger Backcountry Areas would not be suitable for motorized and mechanized use.

The total area of both backcountry areas in Madison, Gallatin, and Henrys Lake Geographic Area is 50,745 acres (or six percent of the 805,299-acre geographic area). The Buffalo Horn Backcountry Area in alternative C at 28,126 acres is larger than alternative B and is suitable for winter and summer motorized and mechanized recreation use. As opposed to alternative B, in alternative C timber harvest is not allowed in the Buffalo Horn Backcountry Area, which may limit some restoration projects requiring vegetation management. The West Pine Backcountry Area is only proposed in alternative C. The area is suitable for mechanized recreation use, but not motorized recreational use. West Pine backcountry area is seventy-seven percent in inventoried roadless area. Therefore, as an effect of alternative C, the remaining twenty–three percent of the backcountry area that is not inventoried roadless area, also has plan components restricting construction of permanent and temporary roads, and limiting motorized access to range improvements to only periodic use.

The following changes in winter recreation opportunities occur under alternative C compared to the current plans:

- Bear Canyon Backcountry Area - a loss of 4,253 acres of winter motorized opportunity.
- Big Pryor Backcountry Area - a loss of 9,249 acres of winter motorized opportunity.
- Punch Bowl Backcountry Area - loss of 2,499 acres of winter motorized opportunity.

In total, there is a loss of 16,001 acres of winter motorized opportunities in backcountry areas in Alternative C compared to the current plans.

Alternative D

Management Direction under Alternative D

Under this alternative there is only one backcountry area, the Chalk Buttes with 5,937 acres in the Sioux Geographic Area. The Chalk Buttes Backcountry Area is proposed only in alternative D. None of the backcountry area is also within inventoried roadless area. The area would be managed for both motorized and non-motorized recreation in both summer and winter and is also suitable for mechanized recreation.

Effects of Alternative D

Alternative D has the least number of backcountry areas and acres of the revised plan alternatives. This allocation would cover three percent of the national forest lands within the Sioux Geographic Area. Allocation as a backcountry area would manage this allocation for less developed, semi-primitive recreation opportunities, with limits on new roads and development while allowing motorized access where it currently exists. Since the lands are not in inventoried roadless areas, the backcountry area limit on new permanent road construction and timber production is a change from the current plans. There are no changes in motorized winter recreation opportunities between the current plans and alternative B. There are no changes in motorized winter recreation opportunities between the current plans and alternative D.

Alternative E

Management Direction under Alternative E

Two backcountry areas are proposed in the Madison, Gallatin, Henrys Lake Geographic Area; Buffalo Horn Backcountry Areas includes the entire 144,064 Hyalite Porcupine Buffalo Horn Wilderness Study Area (on national forest land) and 29,206 acres in Lionhead. Management direction remains the same for the Buffalo Horn Backcountry Area as in B, except additional land would be available for motorized and mechanized recreation opportunity. Wilderness study area direction that is more restrictive than backcountry area direction would be followed, unless Congress released the wilderness study area. Lionhead Backcountry Area appears only in alternative E and would be managed for quiet non-motorized recreation and it is suitable for non-motorized and mechanized recreation.

Effects of Alternative E

Alternative E has the second highest number of acres of backcountry areas, behind alternative C, although it only includes two areas. The combined acres of Buffalo Horn and Lionhead Backcountry Areas would be 173,266 (or 22 percent of this geographic area) and of which, 99 percent is also inventoried roadless area. Bicycle use would be allowed on specified trails in Lionhead. Additional land would be available for motorized and mechanized recreation opportunity within semi-primitive motorized recreational opportunity spectrum corridors in the Buffalo Horn Backcountry Area. Wilderness study area direction that is more restrictive than backcountry area direction would be followed, unless Congress released the wilderness study area.

Compared to the current plans, the Buffalo Horn Backcountry Area in alternative E has an increase of 10,283 acres of winter motorized opportunities.

Consequences to Backcountry Areas from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Vegetation and Timber Management

Backcountry areas are not suitable for timber production in all alternatives. Timber harvest may be allowed for purposes such as fuels reduction, restoration, or wildlife habitat enhancement, except in alternative C for the Pryor Mountains and Buffalo Horn Backcountry Areas. Vegetation management activities, including timber harvest, coupled with vegetation plan components for ecological diversity, resilience and sustainability, would enhance the resilience of backcountry areas.

Effects from Watershed, Riparian, and Aquatic Management

The revised plan alternatives provide more detailed guidance than the current plans for protection of watersheds, riparian areas and aquatic habitats. The revised plan alternatives include the adoption of riparian management zones, which are greater in size from the riparian zones currently identified for streams east of the Continental Divide. Revised plan alternative plan components and objectives for aquatic ecosystems would complement the overall management of backcountry areas by promoting the ecological integrity of watersheds, riparian areas and aquatic habitats.

Effects from Wildlife Management

A key linkage area would overlay the West Bridger and Blacktail Peaks Backcountry Areas proposed in alternative C. Where located within backcountry areas, revised plan alternative plan components for key linkage areas would add additional restrictions to activities otherwise allowed. Permanent facilities and structures (such as trails, fences, etc.), should not be constructed in key linkage areas, unless needed to address ongoing or imminent resource issues within the key linkage area. Low-level helicopter flights may also be restricted.

Effects from Energy and Minerals Management

No alternatives allow new saleable mineral material extraction such as gravel pits in backcountry areas (low development areas). Revised plan alternatives would require that new access to and development of minerals minimize impacts to backcountry areas and that mineral activities consider other resources values that may be present.

Cumulative Effects

The backcountry area allocation would retain the current undeveloped or lightly developed characteristics of between about 5,000 acres and about 250,000 acres, depending on alternative. When coupled with recommended wilderness areas, the revised plan alternatives propose between about 173,000 acres (alternative E) and about 718,000 acres (alternative D) in a more restrictive land allocation than the current plans (about 72,000 acres).

A backcountry area allocation on lands where there is not an existing inventoried roadless area would restrict: timber production on potentially suitable lands, permanent road building, saleable mineral material removal, new communication sites, utility corridors, recreation events, development of recreation facilities, and (in most cases) new motorized trails. While the lightly developed character of these areas is retained, limits on new recreation faculties and uses restricts lands available for potential future recreation facilities to address increasing population growth.

Conclusion

The management of many of the backcountry areas is influenced by the fact that many of the lands are also inventoried roadless areas, which come with an existing national level set of regulations on management activities allowed. The Chalk Buttes, Punch Bowl, Big Pryor Mountain, and Bear Canyon Backcountry Areas are not within inventoried roadless area.

Plan components are sufficient to maintain the current undeveloped or lightly developed characteristics of the backcountry areas. Plan components do so by restricting: new permanent roads, communication sites, utility corridors, saleable mineral material removal, and timber production where those actions would have not have already been restricted, while allowing a mix of non-motorized, mechanized, and motorized recreation opportunities. By allowing timber harvest for purposes such as fuels reduction, restoration, or wildlife habitat enhancement, backcountry areas provide some management flexibility for these areas.

3.22.5 Recreation Emphasis Areas

Affected Environment (Existing Condition)

Recreation emphasis areas are certain areas, lakeshores, trails, road corridors, or river corridors that have existing high use by different types of recreationists. Locations are in the front-country and accessible by roads. Recreation emphasis areas typically offer a variety of quality recreation opportunities, including motorized and nonmotorized uses. The recreation opportunities are accessible to a wide range of users, in several seasons, and typically offer challenges to a wide range of skills. Many of the areas are well known as destinations to generations of forest users. The areas may be regional, national, or international destinations, or may be close to higher population centers. Recreation emphasis areas may have a high density of human activities and associated structures. There may be roads, utilities, and trails as well as signs of past and ongoing activities of managed forest vegetation. Opportunities for solitude and a primitive experience may be limited near roads or trails due to frequent contact with other users. Three of the six forest plan geographic areas have proposed recreation emphasis areas; none are proposed in the Pryor Mountains or in the Ashland or Sioux geographic areas.

Environmental Consequences

Some recreation emphasis areas include lands that are also inventoried roadless areas. Table 200 displays the recreation emphasis areas, total acres and acres within inventory roadless area by alternative.

Table 200. Recreation emphasis areas total acreage, acres and percent within inventory roadless area by alternative

Recreation Emphasis Area	Geographic Area	Alt. B acres	Alt. C acres	Alt. D acres	Alt. E acres	Acres in IRA	Percent in IRA
Main Fork Rock Creek	Absaroka Beartooth Mountains	6,750	6,750	6,681	6,883	Alt B=2,016 Alt C=2,016 Alt D=2,000 Alt E=1,989	29%
West Fork Rock Creek	Absaroka Beartooth Mountains	0	0	0	9,559	4,053	42%
Cooke City Winter	Absaroka Beartooth Mountains	23,742	23,742	0	24,130	Alt B=15,080 Alt C=15,080 Alt E=15,469	64%
Boulder River	Absaroka Beartooth Mountains	7,448	7,448	0	7,448	Alt B=4 Alt C=4 Alt E=71	<1%
Yellowstone River Corridor	Absaroka Beartooth / Madison, Henrys Lk, Gallatin Mts	2,522	2,522	2,409	2,522	Alt B=308 Alt C=134 Alt D=224 Alt E=308	5%
Bridger Winter	Bridger, Bangtail, Crazy Mts	0	0	0	5,354	744	14%
M Trail	Bridger, Bangtail, Crazy Mts	0	0	0	148	144	97%
Hyalite	Madison, Henrys Lake, Gallatin Mts	33,799	65,638	8,530	21,491	Alt B=14,128 Alt C=31,950 Alt D=386 Alt E=1,864	Alt B=42% Alt C=48% Alt D=5% Alt E=9%
Storm Castle	Madison, Henrys Lake, Gallatin Mts	0	0	0	34,620	105	<1%
Gallatin River	Madison, Henrys Lake, Gallatin Mts	17,368	16,150	17,038	17,074	Alt B=6,437 Alt C=5,379 Alt D=6,093 Alt E=6,144	Alt B=37% Alt C=33% Alt D=37% Alt E=37%
Hebgen Winter	Madison, Henrys Lk, Gallatin Mts	72,490	72,491	0	70,052	Alt B=9,144 Alt C=9,145 Alt E=6,697	Alt B=13% Alt C=13% Alt E=10%
Hebgen Lakeshore	Madison, Henrys Lk, Gallatin Mts	13,976	13,978	0	13,977	Alt B=1,720 Alt C=1,720 Alt E=1,720	12%
Total Acres	(no data)	178,094	208,718	34,659	213,258	(no data)	(no data)

Current Plans

Management Direction under the Current Plans

The Custer Forest Plan, as amended, does not have a management area comparable to recreation emphasis areas. Management area F applies developed recreation sites and most of the access corridors and were largely mapped at smaller scales than the revised plan alternatives' recreation emphasis areas.

Gallatin Forest Plan management area 5 direction is comparable to the revised plan alternatives' recreation emphasis areas because the direction acknowledges current high use recreation areas. Management area 5 includes portions of the Gallatin River Canyon, Boulder River, Yankee Jim Canyon of the Yellowstone River, Highway U.S. 212 in the Cooke City vicinity, Highways U.S. 191 and 287 in the West Yellowstone vicinity, and areas adjacent to Hebgen Lake and Hyalite Reservoir. The Gallatin Forest plan, as amended, has 29,913 acres in management areas 5, with some direction to emphasize recreation as a dominant use when considering implementation of other management actions in the specific areas listed.

Gallatin Forest Plan management area 5 direction allows range, wildlife, and fish projects to continue, but states that timber harvest be consistent with a goal to "maintain and improve wildlife habitat values and the natural attractiveness of these areas to provide opportunities for public enjoyment and safety." Other direction includes "shape and scale even-aged openings to replicate natural openings" and "permit commercial and precommercial thinning if it enhances the recreational values of the area."

Effects of the Current Plans

Recreation management would continue to be emphasized in Gallatin Forest Plan management area 5 areas. The 29.913 acres of management area 5 in the current plans are the least amount of area with a recreation emphasis of all alternatives. The individual acres of listed locations within management area 5 were not available to include in table 200.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

All revised plan alternatives have the same management direction for recreation emphasis areas, except for the Hyalite Recreation Emphasis Area in alternative C. These are areas suitable for high amounts of recreation activity, where developed recreation sites are accessible to all users, and outfitter guides provide under-represented communities with a way to access forest activities. Recreation emphasis areas may have loop trails and trails that connect communities to the Custer Gallatin and offer motorized and nonmotorized experiences, many focusing on different seasons of use. Other forest management activities, such as timber harvest and new roads may occur, but will be designed and implemented acknowledging that recreation is a dominant use of the area.

In the Hyalite Recreation Emphasis Area in alternative C, removal of saleable mineral material would not be allowed, construction of new motorized trails would not be allowed, and new trail construction would not be allowed to provide access to Flanders, Mt. Bole, Divide Peak, and Maid of the Mist Peaks. In addition, timber harvest would not be allowed in the portion of the recreation emphasis area within the wilderness study area boundary.

Effects of Alternative B

Alternative B proposes eight recreation emphasis areas for a total of 178,094 acres. This alternative proposes the Main Fork Rock Creek, Boulder River, Cooke City Winter, Yellowstone River, Hyalite, Gallatin River, Hebgen Lakeshore, and Hebgen Winter. Alternative B has the third largest acreage of recreation emphasis areas. Six of the recreation emphasis areas proposed in alternative B are included in Gallatin Forest Plan management area 5 in the current plans. The current plans did not include Main Fork Rock Creek or Hebgen Winter areas.

Inventoried roadless areas within recreation emphasis areas would typically allow less facility development and would limit new road construction, which might be otherwise sought for expansion of developed recreation in some cases within some recreation emphasis areas. It is not necessarily incompatible to have some inventoried roadless areas within the recreation emphasis allocation. The inventoried roadless areas included in these recreation emphasis areas reflect the transition from heavy recreation usage that may occur close to roads to areas further from roads. The Hyalite Recreation Emphasis Area for example, incudes rock climbing areas and high use trails away from roads. The Cooke City Winter Recreation Emphasis Area use is predominantly snowmobile use away from plowed roads.

Effects of Alternative C

Alternative C proposes the same recreation emphasis areas as Alternative B for a total of 208,718 acres. This alternative proposes a larger Hyalite Recreation Emphasis Area than in alternative B. Alternative C has the second largest acreage of recreation emphasis areas.

Alternative C proposes limitations in the Hyalite Recreation Emphasis Areas that are not proposed in other alternatives. The prohibition on the removal of saleable mineral material may reduce the availability of this material for projects within the recreation emphasis area such as roads, trails and trailheads, campgrounds, and other projects. Material needed for these types of projects may need to be purchased and transported from commercial sources resulting in an increase in the use of fuel and project costs.

The prohibition on construction of new motorized trails in this recreation emphasis area would maintain the current footprint of motorized trails in a popular area of growing demand. No new trails would be allowed to provide access to Flanders, Mt. Bole, Divide Peak, and Maid of the Mist Peaks, helping to maintain the current character of this area. In addition, under alternative C, if the wilderness study area were to be released by Congress, timber harvest would still not be allowed in the portion of the recreation emphasis areas within the wilderness study area boundary, about 21,000 acres. Unlike other recreation emphasis areas, the Hyalite REA under this alternative would have restrictions to the growth of some recreation activities.

Effects of Alternative D

Alternative D proposes four recreation emphasis areas for a total of 34,649 acres. This alternative proposes the Main for Rock Creek, Yellowstone River, Hyalite, and Gallatin River. Of these, the Yellowstone River, Hyalite, and Gallatin River Recreation Emphasis Areas would be smaller in alternative D than in all other alternatives. Alternative D has the least acres of recreation emphasis areas of the revised plan alternatives. It includes three of the areas included in the current plans. There would be no recreation emphasis areas representing winter recreation, with the four areas chosen representing only the highest summer use areas for developed recreation facilities on the Custer Gallatin. Reflective of the smaller acreage of recreation emphasis areas than in other revised plan alternatives, there are correspondingly fewer acres of recreation emphasis areas within inventoried roadless areas. Effects of inventoried roadless area within recreation emphasis areas are similar to alternatives B and C.

Effects of Alternative E

Alternative E proposes eleven recreation emphasis areas, for a total of 213,258 acres. This alternative proposes the Main Fork Rock Creek, West Fork Rock Creek and Red Lodge Mountain, Boulder River, Cooke City Winter, Yellowstone River, Hyalite, the M, Bridger Winter, Storm Castle, Gallatin River, Hebgen Lakeshore, and Hebgen Winter. Four if these, West Fork Rock Creek, the M trail, Bridger Winter, and Storm Castle, appear only in this alternative. This has the most recreation emphasis areas and highest acreage of all alternatives. Alternative E includes winter downhill and cross-country ski areas, the iconic M trail adjacent to the town of Bozeman, Storm Castle (which is a more heavily motorized trail experience than other locations), and West Fork Rock Creek at the base of the Beartooth Highway offering developed campgrounds.

Effects of inventoried roadless area within recreation emphasis areas are similar to alternatives B and C. One of the most urban accessible locations, the M trail near Bozeman, is also almost entirely within an inventoried roadless area, which is compatible to the hiking experience offered.

Consequences to Recreation Emphasis Areas from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Vegetation and Timber Management

Recreation emphasis areas do not restrict timber management, except for a portion of the Hyalite Recreation Emphasis Area in alternative C. However, timber production is not suitable in inventoried roadless areas or developed recreation sites, which occur in parts of recreation emphasis areas.

In the current plans, the Gallatin Forest Plan guidance addresses using timber management to enhance recreation values in management area 5. In the revised plan alternatives, recreation emphasis area guidance addresses vegetation management compatibility with the recreational setting. In all alternatives, plan components that provide for restoration efforts, including treatment of diseased stands and hazard tree removal, would provide for visitor safety and healthy functioning settings for recreational activities.

Effects from Fire and Fuels Management

In all alternatives, fire and fuels plan components strive to protect infrastructure that is often associated with recreation emphasis areas. Fuels management components have a desired condition that there are minimal detrimental impacts to values at risk, which would include developed recreation sites. Revised plan alternative plan components support low intensity fire adjacent to infrastructure and the wildland urban interface; some recreation emphasis areas may also be within the wildland urban interface. Therefore, active fuel treatment would be part of protecting recreation facilities from wildfire

Effects from Watershed, Riparian, and Aquatic Management

In all alternatives, plan components provide for the protection of watershed resources within these heavily used recreation areas. The revised plan alternatives provide more detailed guidance than the current plans for protection of watersheds, riparian areas, and aquatic habitats. The revised plan alternatives include the adoption of riparian management zones, which are greater in size from the riparian zones currently identified for streams east of the Continental Divide. Plan components limit new recreation facility development within riparian management zones. Plan objectives call for removing or relocating existing recreation facilities from riparian management zones.

Effects from Wildlife Management

In all alternatives, wildlife plan components for grizzly bears within the recovery zone limit the amount of new developed recreation facilities allowed and require facilities to offer certain food protections and other restrictions. These components offer ways to provide for visitor safety and minimize conflicts in bear country. In addition, where located within recreation emphasis areas, plan components for key linkage areas would add additional restrictions to activities otherwise allowed. Permanent facilities and structures, such as trails, fences, administrative or recreational developed sites, should not be constructed in key linkage areas, unless needed to address ongoing or imminent resource issues within the key linkage area. Low-level helicopter flights may also be restricted.

Effects from Access and Recreation Management

Recreation emphasis areas are highly visited and accessed by maintenance of Level 3 through Level 5 roads. Revised plan alternative plan objectives that prioritize maintenance of Level 3 through Level 5 roads would result in continued access to these areas. Revised plan alternative recreation management plan components for campgrounds, trails, and winter recreation call for public safety to be provided.

Effects from Scenery Management

In all alternatives, the forest plan scenic integrity objectives do not outright prohibit on-the-ground actions, but may influence the design or the location of facilities that would be visible from any of the listed critical viewing platforms. Design features or mitigations may be required to meet or exceed the assigned scenic integrity objective, which describes the lowest maximum threshold of visual dominance and deviation from the surrounding scenic character.

Cumulative Effects

Population growth, urbanization, and growth in travel and tourism are high probabilities over the next 10 to 15 years. These trends would draw more visitors to the western part of the Custer Gallatin and areas such as recreation emphasis areas. While growth is predicted, there are limits to expansion of facilities such as developed campgrounds. The campgrounds that are found in many recreation emphasis areas are unlikely to expand, nor is it likely new ones will be created due to limited budgets and restrictions placed on new developed facilities in the grizzly bear recovery zone. Thus, visitation may outpace capacity for some of these areas. This may not occur in the lifetime of the plan, but it seems likely that, given time, highly in demand parts of the Custer Gallatin will reach some type of recreation use capacity.

Conclusion

Under all revised plan alternatives, plan components along with existing Forest Service policy and direction on management of recreation facilities would provide for accessible recreation opportunities that are responsive to changing visitor demands, visitor safety, and resource protection in heavily visited, recreation-focused areas of the Custer Gallatin.

3.22.6 Stillwater Complex

Affected Environment (Existing Condition)

Within the Stillwater Complex land allocation are significant base, precious, and strategic minerals. The area has been mined since the later portions of the 19th century. Currently, the area hosts two large underground platinum and palladium mines. Both of these mines are operated by the Sibanye Stillwater Mining Company. The Nye Mine was commissioned in 1986 and the East Boulder Mine was commissioned in 2003. Both operations produce platinum and palladium minerals used primarily in air pollution abatement technologies. Other uses include high speed electronic and investment metals.

The Stillwater Complex area is unique in its geographic exposure, its continuity of ore grade, and scale of the mineral deposits. Given the most recent geologic and mineralogical assessments, it is likely that both of these large underground mines could be in operation throughout the lifespan of this forest plan. In recognition of the above information and the fact that mining produces specific surface and subsurface types of disturbance inherent to the production of minerals, the planning team developed a land allocation for this area.

Environmental Consequences

Current Plans

Management Direction under the Current Plans

The 1986 Custer Forest Plan management area E recognizes areas of high mineral potential and existing mineral development activities. The goal of the management area E allocation is to facilitate and encourage the exploration, development, and production of energy and mineral resources from National Forest System lands while mitigating impacts to the extent possible. Management area E is applied to about 23,400 acres in the area of the Stillwater Complex.

The 1987 Gallatin Forest Plan management area 24 consists of active or recently active mineral extraction, processing, and exploratory operations. The goal of the management area 24 allocation is to manage for the orderly exploration and development of mineral resources while mitigating effects on renewable resources. Management area 24 is applied to a number of individual small areas in the area of the Stillwater Complex.

Effects of the Current Plans

Mining operations will continue at the Stillwater Complex in the current plans, and impacts to other resources will be mitigated by following the standards of the current forest plans.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

The Stillwater Complex land allocation comprises 102,945 acres. It includes current operations and mineralized areas where future mining may occur, and the boundary is located on natural features that are locatable on the ground. The land allocation encompasses the parts of the Custer management area E and the Gallatin management area 24 that apply to the Stillwater Complex.

Desired conditions envision the exploration, development, and production of palladium and platinum contributing unique and globally rare minerals for a variety of societal needs, commensurate with conservation of other resources.

The Stillwater Complex land allocation is proposed in alternatives B, C and E. It is not proposed in alternative D because some land in the Stillwater Complex boundary is proposed as recommended wilderness area (in that alternative) and the two allocations would be incongruous on the same land.

Effects of Alternatives B, C and E

The 102,945-acre Stillwater Complex land allocation in alternatives B, C and E specifically recognizes that mining activities will occur in this area.

The Stillwater Complex land allocation overlaps with inventoried roadless area. The Roadless Area Conservation Rule recognizes activities necessary for valid existing rights may occur in inventoried roadless areas.

The Stillwater Complex land allocation overlaps with the Main Boulder River recreation emphasis area and the Boulder River eligible wild and scenic river. The land allocation overlap is compatible in that forest plan direction requires that mining activities take place commensurate with conservation of other resources.

Effects of Alternative D

In alternative D, there would be no Stillwater Complex land allocation. Even without the land allocation, mining is expected to continue to occur in this area. In alternative D, some land in the Stillwater mining area would be recommended wilderness (the potential recommended wilderness coincides with inventoried roadless area). In both recommenced wilderness areas and inventoried roadless areas, activities necessary for the exercise of valid existing rights may occur; such as construction of new roads, trails, or other types of access, regardless of any plan component that says no new roads shall be constructed. Although access is a guaranteed right under the mining laws, the plan component of no new road construction in recommended wilderness areas would likely result in an increase in the length of time to process a minerals plan, additional mitigation requirements, and additional costs for the operations.

Consequences to the Stillwater Complex from Forest Plan Components Associated with other Resource Programs or Management Activities

Plan direction for other resource programs would be in effect in the Stillwater Complex land allocation. Forest plan direction requires that mining activities take place commensurate with conservation of other resources. The energy, minerals, and geologic areas of interest section provides an analysis of consequences to mining from forest plan components associated with other resource programs or management activities.

Cumulative Effects

The platinum and palladium minerals mined at the Stillwater Complex are used in air pollution abatement technologies and contribute to clean air throughout the world. Other uses include high speed electronic and investment metals used worldwide.

Conclusion

Mining will continue at the Stillwater Complex in all alternatives. The Stillwater Complex land allocation in alternatives B, C and E specifically recognizes the mining activities in this area.

3.23 Land Status and Ownership and Land Uses

3.23.1 Introduction

This section addresses land ownership administration, adjustments, and special uses of National Forest System lands on the Custer Gallatin. Management of National Forest System lands include: surveying, marking, and posting of ownership boundaries, acquisition, conveyance and exchange of lands, interests in lands, disposition of title claims and encroachments, acquisition of rights-of-way, and authorization and management of land use authorizations to protect resource values and interest of the public managed by the Forest Service.

Adjustments of land ownership can occur through congressionally mandated conveyances, exchanges, and acquisitions, or through discretionary Forest Service administrative activities. The current proclaimed boundaries of the Custer Gallatin National Forest, and the intermingled public and private landownership pattern within it, are the product of a rich history of Federal laws and actions that originate with the United States Constitution, and include the Acquisition Era (for example, the Louisiana Purchase), the Disposal Era (such as Federal land grants), and the Reservation Era (for example, the creation of the forest reserves and national forests). Collectively, these early land disposal laws and actions significantly affected the land ownership and management of the Custer Gallatin National Forest and surrounding lands.

When the forest reserves and national forests were established in the early 1900's, substantial amounts of lands within these proclaimed boundaries had already been patented and conveyed to state and private ownership, mainly through grants to states, homestead acts, mining laws, and railroad grants.

Land ownership status on National Forest System lands can change over time through land adjustments. Land adjustments involve transfer of fee title and result in a change of legal ownership. The primary methods used by the Forest Service and its cooperators to acquire and conserve private lands within and adjoining the Custer Gallatin National Forest are:

- Land exchange (land-for-land, and land-for-timber)
- Land purchase
- Land donation (voluntary donation by landowner)
- Conservation easements (acquire development rights on private land).

Each of these land adjustment methods has been applied extensively on the Custer Gallatin National Forest to acquire and conserve critical private lands, to improve access, and to improve land management effectiveness.

Lack of reasonable legal access to National Forest System lands results from historic land ownership patterns (for example, private lands in the valleys, public lands in the mountains, intermingled ownership from railroad grants, homestead acts, and mining patents), and more recently from changes in private land ownership and changing attitudes toward public access through private lands. The primary methods used by the Forest Service to acquire and protect access to National Forest lands are land adjustments, cooperative or reciprocal access arrangements, and memorializing existing rights through negotiation or legal action.

All occupancy, use, or improvements on National Forest System lands that are not directly related to timber harvest/forest products, grazing, mining activities, and recreation are referred to as 'special uses' (36 CFR 251.50(a). Special use authorizations fall into two broad categories, recreation special uses and non-recreation (lands) special uses. Recreation special uses include recreational facilities open to the public such as ski areas and resorts, as well as activities and services such as outfitting and guiding and recreation events. Recreation special uses also include private uses, such as recreational residences and organization camps. Non-recreation special uses include water transmission lines, communication facilities, research, and road and utility rights-of-way. The objectives of the Forest Service special uses program are to manage the use and occupancy of National Forest System lands in a manner that protects natural resource values, public health and safety, and is consistent with forest land management plan. Policy is to give preference to uses that offer public service or benefits over single purpose or private uses. Proposals for new uses are carefully screened to determine if the proposed use is in the public interest, or if the use can reasonably be located on non-federal lands.

Communities and businesses in and near the Custer Gallatin rely on utility corridors (energy, fiber optic) and communication sites (cellular, radio, emergency response, etc.). These services contribute to quality of life and community sustainability, providing rural communities the ability to connect in a global or regional economy. Roads, trails, and forest infrastructure provide for safe and reliable access for recreation, resource management, and private inholdings. Access and open space connections are tied to community, quality of life, self-identity, economy and use patterns.

Regulatory Framework

The following is a select set of statutory authorities that govern landownership adjustments and the issuance and administration of special use authorizations. They are briefly identified and described below to provide context to the management and evaluation of these resources. There are multiple other laws, regulations, and policies not described below that also guide the management of these programs; Forest Service Manuals 2700, 5400, and 5500 provide a comprehensive listing.

Organic Administration Act of June 4, 1897 (16 U.S.C. 477-482, 551): authorizes the secretary of agriculture to issue rules and regulations for the occupancy and use of the national forests. This is the basic authority for authorizing use of National Forest System lands for other than rights-of-way.

Occupancy Permits Act of March 4, 1915 (16 U.S.C. 497 et seq.) as amended: authorizes use and occupancy on National Forest System land for recreational purposes including resorts and recreation residences.

General Exchange Act of March 20, 1922 (16 U.S.C. 485, 486): authorized the Forest Service to consolidate its holdings in national forests where a large percentage of private lands were intermingled with National Forest System lands. It made possible the exchange of inholdings within national forests for private lands of equal value and within the same state.

Highway Act of August 27, 1958 (23 U.S.C. 317), supplemented by the Act of October 15, 1966 (49 U.S.C. 1651): authorizes the Federal Highway Administration to grant easements to states for highways that are part of the Federal-Aid System or that are constructed under the provision of chapter 2 of the Highway Act. The Forest Service consents to the grant of these easements in a form agreed upon by the two agencies and upon the state highway agency's execution of stipulations. This is the only authority for granting rights-of-way for projects on the Federal-Aid System or projects constructed under the provisions of chapter 2 of the Highway Act (Forest Service Manual 2731).

National Forest Roads and Trails Act of October 13, 1964 (16 U.S.C. 532-38): authorizes the secretary of agriculture to grant temporary or permanent easements to landowners who join the Forest Service in providing a permanent road systems that serves lands administered by the Forest Service and lands or resources of the landowner. It also authorizes the grant of easements to public road agencies for public roads that are not a part of the Federal-Aid System (Forest Service Manual 2732).

The Act of November 16, 1973 (30 U.S.C. 185), amending Section 28 of the 1920 Mineral Leasing Act: authorizes the Forest Service to issue authorizations for oil and gas pipelines and related facilities located wholly on National Forest System land. When the lands are under the jurisdiction of two or more Federal agencies, authority for issuance is reserved to the United States Department of Interior and Bureau of Land Management, subject to approval by the agencies involved.

Federal Land Policy and Management Act of October 21, 1976 (43 U.S.C. 1761-1771): Title V of the Federal Land Policy and Management Act (FLPMA) authorizes the secretary of agriculture to issue permits, leases, or easements to occupy, use, or traverse National Forest System lands. FLPMA directs the United States to receive fair market value unless otherwise provided for by statute and provides for reimbursement of administrative costs in addition to the collection of land use fees (43 U.S.C. 1764(g)). This act is also very key for land exchanges. Establishes policy for exchange of lands under uniform procedures and that the lands exchanged be consistent with the prescribed mission of the agency.

Alaska National Interest Lands Conservation Act of 1980 (16 U.S.C 3210): provides numerous authorities related to access that are specific to national forests in Alaska (except for sec. 1323(a), which applies to all National Forest System lands; see the following paragraph b). The provisions of section 1323(a) (16 U.S.C. 3210) apply to all National Forest System lands. This section provides that, subject to terms and conditions established by the secretary of agriculture, the owners of non-federal land within the national forest shall be provided adequate access to their land. Regulations implementing section 1323(a) are set forth at Title 36, Code of Federal Regulations, Part 251, and Subpart D -Access to Non-federal Lands. See Forest Service Manual 2701.3, paragraph 3, for the summary of the provisions of 36 CFR 251, Subpart D.

Small Tracts Act of January 12, 1983 (16U.S.C. 521c-521i): authorizes the sale, exchange, or interchange of certain parcels of minimal size.

Act of May 26, 2000 (16 U.S.C. 406l-6d): supplements the authority of the secretary of agriculture to regulate commercial filming and still photography on National Forest System lands. It also authorizes the secretary to retain and spend land use fees collected for commercial filming and still photography without further appropriation, and provides for recovery of administrative and personnel costs in addition to the collection of the land use fee.

March 22, 2012, Executive Order 13604, Improving Performance of Federal Permitting and Review of Infrastructure Projects: states that "it is critical that executive departments and agencies take all steps within their authority, consistent with available resources, to execute Federal permitting and review processes with maximum efficiency and effectiveness…"

August 8, 2005, Energy Policy Act of 2005, Section 1211(c), Access Approvals by Federal Agencies (Public Law 109-58): states "Federal agencies responsible for approving access to transmission and distribution facilities located in the United States shall expedite any Federal agency approvals that are necessary to allow the owners or operators of such facilities to comply with reliability standards regarding vegetation management, electric service restoration, or resolution of situations that imminently endanger the reliability or safety of the facilities."

May 18, 2001, Executive Order 13212, Actions to Expedite Energy-Related Projects: orders executive departments and agencies to take appropriate actions, to the extent consistent with applicable law, to expedite projects that will increase the production, transmission, or conservation of energy.

The following regulations provide direction for special uses management on National Forest System lands:

36 CFR 251 — Land Uses

36 CFR 254 — Landownership Adjustments

Key Indicators and Measures

The indicators and measures used to qualitatively analyze effects or changes to access and land special use opportunities on the Custer Gallatin National Forest are:

- Access provided to and through the planning area for public and forest management measured by the projected right of way acquisitions and type of access needed.
- Limits on new and existing discretionary uses based on land allocations (recommended wilderness, backcountry areas or other special areas), measured in relative amounts of lands in these allocations by alternative.

Methodology and Analysis Process

In this section, access refers to the easements held by the United States government and administered by the Forest Service across non-National Forest land for the management of National Forest System lands. This generally and preferably includes unrestricted access by the public across these lands. Access needed is typically identified in the travel plan for the Gallatin Forest, but was not identified in the travel plans completed on the Custer Forest. Plan components for right of way acquisition are the same in all revised plan alternatives; however, the priority of the type of access to acquire will change based on the alternative.

There may be a change in the types of uses authorized and the location of uses based on the suitability components for the various land allocations. The analysis will look at the number of special use authorizations administered, the types of uses authorized, and the location of the uses compared to potential changes that may result from implementation of the alternatives. This includes existing and potential future uses that may not be suitable in recommended wilderness, backcountry areas, and other special areas.

Information Sources

The Forest Service uses the Land Status Record System as the repository for all realty records and land title documents. The Land Status Record System includes information on ownership acreages, condition of title, administrative jurisdiction, rights held by the United States, administrative and legal use restrictions, encumbrances, and access rights on land or interests in National Forest System lands.

The Forest Service uses the special uses data system to create and administer special-use authorizations. This data is supported by hardcopy files held at the ranger district and forest supervisor's office. A comprehensive geospatial layer of authorized special uses across the Custer Gallatin does not currently exist. The Custer Gallatin is working to collect the data and build a spatial layer that shows the location of all special use authorizations and the type of use authorized.

Analysis Area

The lands considered in this analysis include lands within the proclaimed boundaries of the Custer National Forest and the Gallatin National Forest. The temporal scope is the anticipated life of the plan. The lands within the proclaimed forest boundary form the geographic scope for cumulative effects since this is the scope for the analysis. In looking at trends and future management, the scope takes into account ownership and management of lands adjacent to the Custer Gallatin, including the roads and trails that provide access to the national forest.

3.23.2 Affected Environment (Existing Condition)

Land Ownership and Status

The Custer Gallatin National Forest shares boundaries with other Federal lands including Yellowstone National Park, the Beaverhead-Deerlodge National Forest and the Helena-Lewis and Clark National Forest in Montana, the Caribou-Targhee National Forest in Idaho, the Shoshone National Forest in Wyoming, and the public lands managed by the Bureau of Land Management in Montana and South Dakota. The Custer Gallatin also sits adjacent to tribal, state, and private lands.

The Custer Gallatin consists of approximately 3,039,166 acres of National Forest lands (Federal) and 384,270 acres of private lands, state lands and tribal (non-Federal) lands (USFS Land Area Report, 2015).

Most of the non-Federal land ownership within and adjacent to the Custer Gallatin National Forest consists of intermingled privately-owned lands that were established through ”checkerboard” railroad grants, homestead grants, and patented mining claims, primarily in the late 1800s and early 1900s. In addition, some of the non-Federal lands, notably in the Big Sky and Bangtail Mountain areas, and also on the Sioux Ranger District in South Dakota, were established as a result of land exchanges, primarily from the 1950's to the 1990's.

The remaining areas containing substantial intermingled ownership and checkerboard ownership are in the Crazy Mountains, east side of the Gallatin Range, north Bridger Mountains, Bangtail Mountains, north side of Spanish Peaks, the Cinnabar Basin, Tom Miner and Mol Heron areas, and near Jardine, Cooke City, and Hebgen Lake.

Access

Longstanding Forest Service policy is to acquire and maintain permanent road and trail rights-of-way (access easements) to assure the protection, administration and use of the National Forest System lands and resources. On the Custer Gallatin National Forest, access is a key issue.

The policy for the land adjustment program is to acquire key wildlife habitat and recreation lands, and to improve legal access and management effectiveness through land acquisition. The primary methods used by the Forest Service to acquire and protect access to National Forest lands are land adjustments (land exchange and purchase), cooperative or reciprocal access arrangements, direct negotiation, establishing existing rights through negotiation or legal action, and condemnation.

The Custer Gallatin's land purchase and exchange programs have been very effective in resolving and securing legal access to existing roads and trails within the Custer Gallatin National Forest. The Custer Gallatin's reciprocal access program has also been effective in securing legal access to existing roads and trails across private lands, and in providing legal access across National Forest System lands to lands of other ownership.

Special Uses

The Custer Gallatin National Forest currently administers 860 special use authorizations (475 recreation uses and 385 land uses). Recreation permits include outfitter guide uses, recreation events, recreation residences, resorts, and other uses that are further described in the recreation section.

There are 58 different types of lands uses (non-recreation) authorized by permits, leases, and easements on the Custer Gallatin ranging from research activities to more extensive uses such as water systems, communications facilities, roads, utilities. The majority of land use authorizations are issued for transportation purposes (highways and roads for private land access) and water systems serving private property (ditches and water lines). Table 201 summarizes the types of use on the Custer Gallatin and the number of authorizations issued.

Table 201. Special use authorizations[1]

Type of Use	Number of Authorizations
Agriculture	8
Community Services and Public Information	15
Research, Training, Cultural Resource Survey	17
Industry, Storage, Stockpile Sites	6
Energy and Gas Transmission	21
Transportation	162
Communication Uses	38
Water	99
Filming and Photography	19
Recreation Residences	292
Outfitter and Guide Services	140
Other Recreation Uses	43

1. Data pulled from Special Uses Data System August 2018

3.23.3 Environmental Consequences

Current Plans

Management Direction under the Current Plans

Longstanding Forest Service policy for the Landownership Adjustment Program is to acquire and consolidate key tracts of private land to protect and enhance wildlife and fish habitat, wilderness, recreational opportunities, wetlands and riparian areas, and to improve legal access and long term management effectiveness. These goals and objectives are reflected in the 1987 Gallatin Forest Plan and the 1986 Custer National Forest Management Plan.

The current forest plans contain a brief discussion that proposals for special uses will be evaluated on a case-by-case basis and need to meet the direction in the plan. In addition, there is direction that energy transmission and communication uses may be authorized, however, where technically feasible, new lines will be installed underground. In both plans, approval of special uses is subject to the overall forest and management area direction.

The Gallatin Travel Plan identifies rights of way needed for recreation and forest management, but neither current forest plan contains a numerical objective for rights of way acquisition.

Effects of the Current Plans

The current plans have the least amount of acres that are not suitable for some special uses such as powerlines and communication uses. While neither current forest plan contains a numerical objective for rights of way acquisition, the Forest on average acquires about 5 access routes per decade.

Revised Plan Alternatives

Management Direction under the Revised Plan Alternatives

The plan components developed for lands are based on Forest Service policy and remain the same in all revised plan alternatives. There is an objective for right of way acquisition defined in the revised plan alternatives. All revised plan alternatives include plan components that would provide additional direction for approval of land uses in riparian areas. There is an objective to remove all facilities, improvements, or uses in designated wilderness currently authorized by special use permit that are not suitable for wilderness.

Effects of the Revised Plan Alternatives

None of the revised plan alternatives proposes to make any site-specific changes to the existing landownership on the Custer Gallatin National Forest. No conveyances (acquisitions, disposals, or exchanges) are proposed. Any of these actions would be considered at the project level. Criteria to consider when evaluating lands for acquisition or conveyance are discussed in the management approaches section of the forestwide direction.

Under all revised plan alternatives, proposals for new land uses would be screened according to policy (36 CFR 251.54) and the authorized uses would be managed with terms and conditions that protect forest resources. New proposals for some special uses (for example, power lines and commercial communication uses) are not suitable in recommended wilderness areas, backcountry areas, the wilderness study area, and other special areas. Based on land allocations, alternative D would have the greatest number of acres that are not suitable for some lands uses, followed by alternative C, then B, and then E.

There is an objective for right of way acquisition defined in the revised plan alternatives; however, the priority for the type of access acquired will vary by alternative (for example, roads to access areas for vegetation management or trails for recreational access). In alternative D, the priority for acquisition of rights of way needed would be to provide access to recreation facilities and trails. In alternative E, the priority for acquisition of rights of way needed would be to provide access to support vegetation management projects. Priorities for acquisition of rights of way in alternatives B and C would be to support a mix of recreation and forest management access needs.

Where recommended wilderness areas contain existing land uses, future management of that use could be affected. Permittees that have uses within recommended wilderness areas could potentially have increased administrative terms and conditions that make it more difficult to operate as compared to alternatives with less recommended wilderness area allocation. Authorized uses would need to be identified, reviewed (to determine if they meet the suitability components for the area), and modified or removed. Motorized access for operation and maintenance of authorized uses, may be subject to increased review for authorization in recommended wilderness areas.

In alternatives B, C, and D there are existing communication uses authorized within recommended wilderness areas. In alternative B there are three authorized communication uses within the Gallatin Crest Recommended Wilderness Area. Two of these uses are single user sites located on Steamboat Mountain and Twin Peaks. Northwestern Energy has authorization for the operation of a microwave facility on Steamboat Mountain. The facility consists of a small, 10 foot by 10 foot metal building, a 20-foot antennae, and associated solar panels. Qwest Corporation has an authorization to operate two, 24 foot by 30 foot, passive reflectors on Twin Peaks. The two reflectors are used for microwave telephone relay. The third site is a Forest Service owned building and tower on Eaglehead. Gallatin County, Montana Department of Transportation, and a private commercial user are co-located in this Forest Service building and provide additional communication services from this site. These communication uses would continue to be suitable uses in recommended wilderness areas in alternative B.

In alternatives C and D, the communication uses on Steamboat Mountain, Twin Peaks, and Eaglehead are located in the proposed Gallatin Wilderness. An additional communication use on Sheep Mountain is also in this area. Qwest Corporation has an authorization for operation of a 40-foot by 48-foot passive reflector on Sheep Mountain. The reflector is used to reflect microwave radio beams between the radio terminal located in West Yellowstone and the radio terminal at the Tom Minor repeater. Authorized communication uses at all four sites would need to be evaluated for suitability with the plan components, moved outside the recommended wilderness area, or phased out over time with impacts to the holder.

In other land allocations, existing facilities, including commercial communication facilities, would be allowed to continue. In the current plans and alternative E, these four commercial communication uses would be allowed to continue because they are not located in recommended wilderness areas.

Consequences to Land Status, Ownership and Uses from Forest Plan Components Associated with other Resource Programs or Management Activities

Effects from Watershed, Riparian, and Aquatic Management

The revised plan alternatives provide more detailed guidance than the current plans for protection of watersheds, riparian areas, and aquatic habitats. All revised plan alternatives provide direction and guidance for the management of land uses to protect watershed, riparian, and aquatic habitats, most specifically within riparian management zones. Where possible, new land uses and reauthorizations would be located outside of these zones, or impacts within these zones would be minimized. Plan components for riparian zones may limit road construction and vegetation management activities that could occur in association with land use permits.

Effects from Scenery Management

In all alternatives, the forest plan scenic integrity objectives do not outright prohibit on-the-ground actions, but may influence the design or the location of on-the-ground projects that would be visible from any of the listed critical viewing platforms. Design features or mitigations may be required to meet or exceed the assigned scenic integrity objectives, which describes the maximum threshold of visual dominance and deviation from the surrounding scenic character.

Effects from Wildlife Management

In all alternatives, wildlife plan components for species such as grizzly bears may restrict the location or installation of land uses or the timing of activities. The revised plan alternatives add direction for certain species such as plan components for priority sage grouse habitat, or near white tail prairie dog colonies. In addition, in all alternatives, all special use permits require food storage in the montane area of the Custer Gallatin.

Cumulative Effects

Cumulative effects evaluate the potential impacts to National Forest System lands and special uses from the proposed action when combined with past, present, and reasonably foreseeable actions. In order to integrate the contributions of past actions to the cumulative effects of the proposed action and alternatives, existing conditions are used as a proxy for the impacts of past actions. This is because existing conditions reflect the collective impact of all prior actions that have affected landownership and special uses and might contribute to cumulative effects. Landownership and special uses can be expected to be influenced by a variety of factors.

The Custer Gallatin National Forest has administrative responsibilities for over 3 million acres of National Forest System lands and more than 384,000 acres of non-Federal lands within the national forest boundary. Of the Custer Gallatin managed lands, nearly 200,000 acres were acquired or placed under Forest Service management though land purchases, land exchanges, land donation, and conservation easements since the last planning effort. Adjustments in landownership on the Custer Gallatin will continue. Several land exchanges are currently underway. When these exchanges are finalized, the Forest Service will acquire lands that consolidate ownership, enhance recreation opportunities, provide public access, and protect aesthetic values. In addition, the Custer Gallatin has been working with landowners and partners in the Crazy Mountains area to develop projects that would consolidate the checkerboard landownership pattern and provide additional access to National Forest System lands.

Partnerships with national nonprofits (Rocky Mountain Elk Foundation, Trust for Public Lands, etc.), local access advocacy groups, and the state have been productive in resolving access issues and are becoming more necessary as the Forest Service is faced with reduced budgets and staffing in lands.

Boundary surveying and marking will continue, and encroachments are likely to be discovered. Increased housing density in areas adjoining National Forest System lands can increase the potential for encroachment, trespass, and unauthorized use and occupation of the public's land and resources.

The Custer Gallatin can expect requests for special use authorizations to increase. As more private land is subdivided, an associated increase in requests for special use authorizations such as road and utilities will result. Under section 368 of the Energy Policy Act of 2005, the Forest Service and Bureau of Land Management coordinated to review and designate energy corridors crossing Federal lands in the 11 contiguous western states. None of the section 368 designated corridors cross the Custer Gallatin National Forest; however, the agencies continue to work together to consider future delivery of electricity across Federal lands. As technological advances are made (such as broadband, fiber optic cable), requests for modification of existing authorized communications sites and approval of new communication uses can reasonably be expected.

As human population increases, expected trends include a greater use of National Forest System lands by the public, particularly those areas close to population centers. There is also expected to be more development of private lands adjacent to forest and on private inholdings in the national forest boundary. Private access needs will likely increase. This may also result in challenges from other land owners to existing and perceived access to National Forest System lands, as private landowners are becoming more reluctant to grant easements. Access in general across all National Forest System lands is becoming more difficult to obtain. This is expected to continue into the future.

Adjacent national forests manage land uses and land status in a similar manner as the Custer Gallatin National Forest. Adjacent and nearby BLM lands also allow similar land uses as national forests, while adjacent Yellowstone National Park is more limited than national forests in the uses allowed. State laws and county ordinances apply to these activities on adjacent private lands.

Conclusion

The plan components will provide for continued land adjustment and right of way acquisition. Riparian plan components in all revised plan alternatives would limit new uses or require extra measures for new uses. The revised plan alternatives would limit some new and existing special uses is some land allocations, with the most affected acres in alternative D, followed by alternatives C, B, E and then the current plans.

Chapter 4. Other Disclosures, Preparers, and Distribution of the Environmental Impact Statement

4.1 Other Required Disclosures

4.1.1 Environmental Justice

As required by Executive Order 12898, all federal actions must consider potentially disproportionate effects on minority or low-income communities. The Custer Gallatin Forest Plan is strategic and programmatic in nature, providing guidance and direction to future site-specific projects and activities. The Plan does not create, authorize, or execute any ground-disturbing activity, although it does provide for the consideration of certain types of activities. Site-specific activities will consider potential disproportionate effects on minority or low-income communities during project planning.

The General Contributions to Society and Economic Sustainability section of Chapter 3 did not identify any disproportionate impacts from forest management. In addition, collaboration on the plan did not identify any concerns regarding disproportionate impacts to low-income or minority populations. The Custer Gallatin also coordinated and consulted with federally recognized tribes that had or have traditional uses within the national forest boundary (the Areas of Tribal American Interest section of chapter 3 provides further detail). No disproportionate impacts were identified by the tribes.

4.1.2 American Indian Religious Freedom Act

Agencies must make a good faith effort to understand how Indian religious practices may come into conflict with other forest uses and consider any adverse impacts on these practices in their decision-making practices. The Custer Gallatin National Forest consults with 18 federally recognized tribes located in North and South Dakota, Montana, Wyoming, Idaho, Oregon, and Washington who have communicated interest in the natural and cultural resources and management of the Custer Gallatin National Forest as part of their aboriginal or traditional use areas. They include:

MHA Nation – Mandan, Hidatsa, and Arikara (Sahnish)

Cheyenne River Sioux Tribe

Rosebud Sioux Tribe

Northern Cheyenne Tribe

Confederated Salish Kootenai Tribes

Umatilla Confederated Tribes

Eastern Shoshone Tribe

Crow Tribe

Confederated Bands and Tribes of the Yakama Nation

Standing Rock Sioux

Lower Brule Sioux Tribe

Pine Ridge Sioux Tribe

Ft. Peck Sioux and Assiniboine Tribes

Nez Perce Tribe

Shoshone Bannock Tribe

Arapahoe Tribe

Crow Creek Sioux Tribe

Blackfeet Nation

No effects on American Indian social, economic, or subsistence rights are anticipated as a result of this forest plan revision effort. No matter which alternative is chosen for implementation, the national forest will be required to consult with tribes when management activities may impact treaty rights or cultural sites and cultural use. Desired conditions for American Indian Rights and Interests, for revised plan alternatives, would be that culturally significant species and the habitat necessary to support healthy, sustainable, and harvestable plant and animal populations support rights reserved by tribes in treaties; national forest resources are available for collection by tribal members with treaty rights; and tribal members have access to sacred sites and landscapes within the Custer Gallatin National Forest and for the exercise of reserved treaty rights and cultural uses.

4.1.3 Unavoidable Adverse Effects

Forest plan revision and forest plans do not produce unavoidable adverse effects because they do not directly implement any management activities that would result in such effects. However, the forest plans do establish management emphasis and direction for implementation of activities that may occur on National Forest System lands in the planning period. If those activities occur, the application of forestwide and geographic area standards and guidelines (as described in the draft revised forest plan) would limit the extent and duration of any resulting environmental effects. Some unavoidable effects could still occur; however, these potential effects are described by resource area throughout chapter 3 of this Custer Gallatin Environmental Impact Statement, primarily under "Environmental Consequences."

4.1.4 Relationship of Short-term uses and Long-term Productivity

Short-term uses are those expected to occur for the planning period (10 to 15 years), including recreation use, timber harvest, and prescribed burning. Although the forest plan does not directly implement these uses, the potential for these uses are described in the forest plan goals and objectives, both at the forestwide and geographic area levels (see revised forest plan).

Long-term productivity refers to the capability of the land to provide resource outputs for a period of time beyond the planning period. Minimum management requirements, established by regulation (31 CFR 219.27), provide for maintenance of long-term productivity of the land. Minimum management requirements are contained in forestwide and geographic area standards and guidelines and would be met under any alternative. They ensure that the long-term productivity of the land is not impaired by short-term uses.

Monitoring and evaluation, as described in the revised forest plan, applies to all alternatives. A primary purpose of monitoring is to ensure that long-term productivity of the land is maintained or improved. If monitoring and evaluation show that forest plan standards and guidelines are inadequate to protect long-term productivity of the land, then the plan will be adjusted (through amendment or revision) to provide for more protection or fewer impacts.

Although all alternatives are designed to maintain long-term productivity, there are differences among the alternatives in the long-term availability or condition of resources. There may also be differences among alternatives in long-term expenditures necessary to maintain or achieve desired conditions. The differences are discussed throughout the various sections in chapter 3 of this document.

4.1.5 Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable commitments of resources are defined in Forest Service Handbook 1909.15, Environmental Policy and Procedures.

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road.

The decisions made in forest plan revisions do not represent actual irreversible and irretrievable commitments of resources. This is because forest planning identifies what kinds and levels of activities are appropriate in different parts of the forest; it does not make project decisions. Ground-disturbing activities cannot occur without further site-specific analyses, section 7 consultation required under the Endangered Species Act, and project decision documents.

4.1.6 Energy Requirements and Conservation Potential

Energy is consumed in the administration of natural resources from the national forests. The main activities that consume energy are timber harvest, recreation use, road construction and reconstruction, minerals and energy exploration and development, transporting and managing livestock, and administrative activities of the Forest Service and other regulatory agencies. Energy consumption is expected to vary only slightly by alternative.

4.1.7 Prime Farmland, Rangeland, and Forestland

No prime farmland, rangeland, or forestland has been identified in the planning area. Forest plan revision or the forest plan would not directly affect such lands; although implementation of the plan could have indirect effects. Regardless of the alternative selected for implementation, National Forest System lands would be managed with sensitivity to the values of any adjacent private or public lands.

4.1.8 Threatened and Endangered Species

Potential effects to species listed under the Endangered Species Act can be found in chapter 3 of document. The Biological Assessment and Biological Evaluation will be finalized for the final forest plan and final environmental impact statement. Management direction to protect at-risk species, or to provide for their habitats, can be found in the revised forest plan (forestwide and geographical area desired conditions, standards, and guidelines).

4.1.9 Wetlands and Floodplains

Forest plan revision and forest plans do not directly implement any management activities that would result in loss of wetland or floodplains. Revised forestwide management direction provides a broad spectrum of standards and guidelines designed to protect soil, water, riparian, and aquatic resources. The goals and intent of Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands) would be met through compliance with this direction. Documentation for this conclusion can be found in this environmental impact statement, chapter 3, Watershed, Aquatic Species/Habitat, and Riparian Ecosystems section and in the revised forest plan (desired condition, standards, and guidelines).

4.1.10 Conflicts with Other Agency or Government Goals or Objectives

Contact, review, and public involvement with other Federal and State agencies indicate no major conflicts between the revised forest plan and the goals and objectives of other governmental entities. This review is documented in appendix E of the draft environmental impact statement and the cumulative effects analysis of many sections of this document.

4.2 Preparers

Core Planning Team Members

Name	Responsibility	Years of Experience
Gunnar Carnwath	Vegetation, Timber	18
Jake Chaffin	Watershed, Fisheries	16
Bev Dixon	Wildlife	35
Mary Gonzales	GIS	33
Virginia Kelly	Team Leader	35
Mariah Leuschen-Lonergan	Public Affairs, Collaboration	13
Pam Novitzky	Recreation, Designations	35

Extended Team Members

Name	Responsibility	Years of Experience
Julia Barton	Administrative	15
Kami Crootof	GIS	15
Shelly Deisch	South Dakota Game, Fish and Parks Compatibility Review	30
Todd Erdody	Fire and Fuels	15
Josh Hemenway	Wildlife	8
Eric Henderson	Analyst	15
Michael Inman	Park County, Montana Compatibility Review	14
Tom Keck	Soils	30
Jonathan Kempff	Infrastructure	39
Halcyon LaPoint	Cultural, Historic Resources; Tribal Liaison	30
Jordan Larson	Economics	12
Mark Beth Marks	Minerals	37
Kathy Nash	Lands, Special Uses	25
Lauren Oswald	Forest Plan Allocations	18
Rebecca Rasch	Social Science	10
Kim Reid	Grazing, Invasives, At-Risk Plants, Vegetation, Designations	40
Jane Ruchman	Scenery	35
Randy Scarlett	Wildlife	17
Mark Story	Air Quality	38

4.3 Distribution of the Environmental Impact Statement

Agencies, Organizations and People to Whom the Draft Environmental Impact Statement is Being Sent

Adjacent State, Local, and Federal Partners

- Internal Federal Employees
- All 7 Ranger Districts
- National Park Service, Yellowstone National Park
- Bureau of Land Management
  (Montana/Dakota State Office, Billings Field Office, Butte Field Office)
- Environmental Protection Agency, Region 8
- Planning and Review Advisory Council on Historic Preservation
- USDA Animal and Plant Health Inspection Service
- Rural Utilities Service
- Natural Resources Conservation Services
- National Agricultural Library
- Energy and Environmental Readiness Division
- Office of Environmental Management
- U.S. Army Corp of Engineers
- Department of Energy
- Department of Interior, Office of Environmental Policy and Compliance
- Northwest Power Planning Council
- Federal Aviation Administration
- Federal Highway Administration
- Montana Fish, Wildlife and Parks
- South Dakota Game, Fish and Parks
- Montana and South Dakota Governor's Offices
- Montana Department of Natural Resources
- U.S. Fish and Wildlife Service
- Rocky Mountain Research Station
- Caribou Targhee National Forest
- Shoshone National Forest
- Beaverhead-Deerlodge National Forest
- Montana and South Dakota Capitol City Coordinators
- Helena, Lewis and Clark National Forest
- Northern Rockies Regional Office
- South Dakota Agriculture, Health and Natural Heritage Program
- South Dakota Commission on Schools and State Lands
- Montana Department of Transportation
- Montana State University (Interested Faculty, Staff)

Adjacent Town, Chambers and County Contacts

- West Yellowstone Chamber
- Town of West Yellowstone
- Cooke City Chamber
- Gardiner Chamber
- Red Lodge Area Chamber
- Bozeman City Plan/Engineering and City Commission
- Public Libraries (Reference Desks) 15 Public Libraries and 10 Tribal Colleges

County Commissioners

- Gallatin County: Joe Skinner, Steve White, Don Seifert
- Park County Commissioners: Steve Caldwell, Bill Berg, Clint Tinsley, (DeAnn Weickum)
- Stillwater County Commissioners: Dennis Shupak, Mark Crago, Maureen Davey, (Lori Dobitz)
- Sweet Grass County Commissioners: Bill Wallace, Bob Faw, (3rd vacant)
- Carbon County Commissioners: Robert DeArmond, Scott Blain, Bill Bullock
- Yellowstone County Commissioners: John Ostlund, Robyn Driscoll, Denis Pitman
- Meagher County: Ben Hurwitz, Herb Townsend, Rod Brewer
- Powder River County Commissioners: Donald Zimmer, Donna Giacometto, Rod Schaffer
- Bighorn County Commissioners: George Real Bird III, Sidney Fitzpatrick, Chad Fenner, (Candy Wells)
- Harding County, SD County Commissioners (Kathy Glines)
- Madison County Commissioners: Jim Hart, Dan Allhands, Ron Nye (Jani Flinn, Laurie Buyan)
- Rosebud County Commissioners: Robert E. Lee, Douglas Martens, Ed Joiner (Charlene Berdahl)
- Carter County Commissioners: Rod Tauck, James E Courtney, Steve Rosencranz

Collaborative – Custer Gallatin Working Group Members

U.S. Congressional Delegation

- Senator Jon Tester (D)
- Senator Steve Daines (R)
- Congressman Greg Gianforte (R)

State Representatives

- Senator Jedediah Hinkle
- Representative Kerry White
- Senator Scott Sales
- Representative Walt Sales
- Senator Nels Swandal
- Representative Alan Redfield
- Senator David Howard
- Representative Seth Berglee
- Senator Jason Small
- Representative Sharon Steward-Peregoy
- Representative Rae Peppers
- Senator Frederick (Eric) Moore
- Representative Bill Harris
- Senator Gordon Vance

- Representative Jim Hamilton
- Representative Laurie Bishop
- Representative Forrest Mandeville
- Senator Tom Richmond
- Representative Sue Vinton
- Representative Vince Ricci
- Senator Roger Webb
- Representative Dennis Lenz
- Senator Duane Ankney
- Representative Barry Usher
- Representative Tom Woods
- Representative Jon Knokey
- Representative Bruce Grubbs

*or respective representative given the electoral season.

Tribal Leadership

- Cow Creek Sioux Tribe
- Lower Brule Sioux
- Rosebud Sioux
- Oglala Sioux
- Cheyenne River Sioux
- Standing Rock Sioux
- Three Affiliated Tribes – Mandan, Hidatsa, Arikara
- Eastern Shoshone
- Northern Arapaho
- Fort Peck Assiniboine (Nakona) and Sioux (Dakota) Tribes
- Northern Cheyenne
- Crow Apsaalooke
- Blackfeet
- Confederated Salish and Kootenai Tribes
- Shoshone-Bannock
- Nez Perce
- Confederated Tribes of the Umatilla – Umatilla, Walla Walla, Cayuse
- Confederated Tribes and Bands of the Yakama Nation
- Pikakkanni (Blackfeet)
- Turtle Mountain

Other

This category consists of environmental organizations, nongovernmental, industry, and other interests, as well as interested and select members of the public as part of opt-in mailing list (electronic and hardcopy options) – Approximately 7,000 recipients. This category also includes the following types of media.

Traditional Print & Web-based Media Outlets

- Montana Associated Press
- Daily Newspapers
  - Billings Gazette (paper of record)
  - Bozeman Chronicle (paper of record)
  - Rapid City Journal (paper of record)
  - Helena Independent Record
  - Montana Standard
  - Livingston Enterprise
  - Missoulian
- Weekly Newspapers
  - Belgrade News (biweekly)
  - Nation Center News – Buffalo
  - Ekalaka Eagle
  - Powder River Examiner
  - Cooke City Newsletter (Community Newsletter)
  - West Yellowstone Star
  - West Yellowstone Chamber News

- Big Timber Pioneer
- Carbon County News
- Stillwater County News
- Explore Big Sky
- Laurel Outlook
- Gardiner Chamber (Ad – based only)
- Bighorn Country News
- Cody Enterprise (biweekly)
- Powell tribune
- Tri-State Livestock News
- Miles City Star
- Forsyth County News

Web-based Media/ Quarterly Magazine-Based

- Cowles Montana Media
- Town Square Media - - connoisseurmedia.com
- Calendar of events
- Big Timber Buzz (FB sharing group – necessary)
- Gardiner Buzz (FB sharing group – necessary)
- Bozone – listserve (sharing group necessary)
- Outside Bozeman
- Montana Outside
- The Hyalite
- Yellowstone Valley Woman (Billings)

Radio Media

- Montana Public Radio/Yellowstone Public Radio
- KEMC-FM Billings
- KEMC-FM Billings
- KAPC-FM Butte
- KYPM-FM Livingston
- Northern News Broadcasting,
- KIKC Range Web (Eastern Montana – Broadus, Ashland, Miles City, Ekalaka)
- KULR Radio,
- Billings MOJO,
- Big sky Radio
- Planet 106.7
- KISS – FM – Bozeman

Television Media

- KTVQ—Billings, MT
- ABC- Fox Montana —Butte, Bozeman, MT
- KBZK – (CBS) - Bozeman, MT
- KULR 8 —Billings, MT
- KTVM – (NBC Montana) – Bozeman, Missoula

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