

Biological Assessment for Threatened, Endangered, Proposed and Candidate Species

Revised Forest Plan for the Custer Gallatin National Forest

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List of Terms and Abbreviations

Terms used in this document

Term	Full name/additional information
the Forest	Custer Gallatin National Forest
the Service	U.S. Fish and Wildlife Service
Grizzly Bear Conservation Strategy	Conservation Strategy for Grizzly Bears in the Greater Yellowstone Ecosystem
Revised forest plan	Custer Gallatin National Forest Revised Land Management Plan
Custer forest plan	Custer National Forest Land and Resource Management Plan (1986)
Gallatin forest plan	Gallatin National Forest Land and Resource Management Plan (1987)
2012 Rule	the 2012 Planning Rule as described in 36 CFR Part 219, Subpart A

Abbreviations used in this document

Abbreviation	Full term/description
AB	Absaroka-Beartooth (reference to forest plan Geographic Area)
BA	biological assessment
BASI	best available scientific information

Abbreviation	Full term/description
BBC	Bridger/Bangtail/Crazy (reference to forest plan Geographic Area)
BMU	Bear management unit
BO	biological opinion
CFR	Code of Federal Regulations
CGNF	Custer Gallatin National Forest
dbh	diameter at breast height
DC	desired condition (reference to forest plan component)
DPS	Distinct population segment as determined by the US Fish and Wildlife Service
EIS	environmental impact statement (DEIS = draft EIS; FEIS = final EIS)
ESA	Endangered Species Act
ESI	early stand initiation
FS	Forest Service
FW	forestwide (reference to forest plan component)
GA	Geographic Area
GBCS	Grizzly Bear Conservation Strategy
GDL	guideline (reference to forest plan component)
GIS	geographic information system
GO	goal (reference to forest plan component)
GYE	greater Yellowstone ecosystem
IGBC	interagency grizzly bear committee
IRA	Inventoried roadless area
ITS	Incidental take statement
LAU	Lynx analysis unit
LCAS	Lynx Conservation Assessment Strategy
MFWP	Montana Fish, Wildlife and Parks
MHG	Madison/Henrys/Gallatin (reference to forest plan Geographic Area)
NCDE	Northern Continental Divide Ecosystem
NF	National Forest
NFS	National Forest System
NRLMD	Northern Rockies Lynx Management Direction
NRV	natural range of variation
OBJ	objective (reference to forest plan component)
OMARD	open motorized access route density
PCE	primary constituent element
PM	Pryor Mountains (reference to forest plan Geographic Area)
PVT	potential vegetation type
RMZ	riparian management zone

Abbreviation	Full term/description
ROD	record of decision
ROS	recreation opportunity spectrum
RWA	recommended wilderness area
STD	standard (reference to forest plan component)
SUIT	suitability (reference to forest plan component)
TMARD	total motorized access route density
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
WSA	wilderness study area
WUI	wildland urban interface

Introduction

Threatened, endangered, and proposed species are managed under the authority of the Endangered Species Act (ESA) of 1973 (PL 93-205, as amended) and the National Forest Management Act (NFMA) of 1976 (PL-94-588). Section 7 of the ESA requires federal agencies to ensure actions authorized, funded, or carried out by them 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 (16 USC 1536). The NFMA requires the preparation of an integrated land management plan for each unit of the National Forest System. A Biological Assessment (BA) must be prepared for federal actions to evaluate the potential effects of the proposal on listed or proposed species and their habitat (50 CFR 402.12(b)). This document contains the Biological Assessment for the revised land management plan (forest plan) covering the Custer Gallatin National Forest. In accordance with Section 7 of the ESA, the U.S. Fish and Wildlife Service has determined that the following threatened, endangered and proposed species and designated critical habitat may be present on the Custer Gallatin National Forest.

Federally designated species and designated critical habitat

In accordance with section 7(c) of the ESA, a current list of federally designated species that may be present on the Custer Gallatin National Forest was obtained from the U.S. Fish and Wildlife Service, Ecological Services (Bush 2019), see table 1.

Table 1. Federally designated species and critical habitat on the Custer Gallatin National Forest

Species	Status	Possible Occurrence
Whooping Crane (<i>Grus americana</i>)	Endangered	Wetlands; migrant in eastern Montana and South Dakota units of CGNF (Sioux Geographic Area)
Grizzly Bear (<i>Ursus arctos horribilis</i>)	Threatened	Resident and transient; alpine/subalpine coniferous forest; South of I-90; excluding the Pryor Mountains
Canada Lynx (<i>Lynx canadensis</i>)	Threatened Critical Habitat	Resident – core habitat, montane spruce/fir forests Transient – secondary/peripheral lynx habitat
Northern Long-eared Bat (<i>Myotis septentrionalis</i>)	Threatened	Carter and Powder River Counties (Montana) and Harding County (South Dakota) portions of CGNF; caves, abandoned mines; roosts in live trees and snags
Wolverine (<i>Gulo gulo luscus</i>)	Proposed	High elevation alpine and boreal forest that are cold and maintain persistent snow into late spring.
Western Glacier Stonefly (<i>Zapada glacier</i>)	Threatened	Clean, cold, running water with high oxygen content;
Whitebark Pine (<i>Pinus albicaulis</i>)	Candidate	Forested areas in central and western Montana; high elevation, upper montane habitat near treeline

Source: Letter from J.Bush, dated October 22, 2019; Email T.Olenicki dated January 29, 2020

Need for Reassessment Based on Changed Conditions

The Biological Assessment findings are based on the best current data and scientific information available. A revised Biological Assessment must be prepared if: (1) new information reveals effects, which may impact threatened, endangered, and/or proposed species or their habitats in a manner or to

an extent not considered in this assessment; (2) the proposed action is subsequently modified in a manner that causes an effect that was not considered in this assessment; or (3) a new species is listed or habitat identified, which may be affected by the proposed action.

Description of the proposed action

The Forest Service proposes to revise and combine the 1986 Custer National Forest and 1987 Gallatin National Forest Land and Resource Management Plans (Forest Plans). The two forests were formally consolidated in 2014 into the Custer Gallatin National Forest. The purpose of the revision is to create one unified land management plan for the combined Forest, as well as to address gaps in current plan direction, and changes in ecological, social and economic conditions. The revised plan will provide consistent direction across a landscape that encompasses over 3 million acres of public land in the Forest Service's Northern Region. It is important to note that the revised plan does not authorize, fund or carry out site-specific prohibitions or activities; rather it establishes overarching direction for future land management actions. Management direction in the revised forest plan will go into effect once the final record of decision is signed by the Forest Supervisor, and is expected to guide management and decision-making processes for approximately 15 years.

Information Sources

This biological assessment was based on an extensive review of, and contains reference to, the best available scientific information for purposes of documenting the status, habitat relationships, potential threats and response to management activities of threatened, endangered, proposed and candidate species known to occur, or that may be present within the Custer Gallatin National Forest boundary. Literature cited generally includes current, peer-reviewed articles that are local in scope or directly applicable to local ecosystems. Literature from further regions with habitats or ecological conditions similar to those found in the Custer Gallatin National Forest, were often pertinent and therefore also used in this assessment. Uncertainty and conflicting conclusions found in the literature are acknowledged and interpreted where possible based upon local knowledge and data. Key information on population trends, life history and species occurrence 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 and the Interagency Grizzly Bear Study Team. Local data collected by Forest Service personnel, contractors and agency partners informed analyses with respect to species occurrence, abundance, and distribution, as well as local habitat conditions and trends. Numbers, such as acres, miles and densities reported in this assessment are approximates due to the use of geographic information system (GIS) data and rounding.

Action area

The action area, also referred to in this document as "the Forest", or "plan area", is the Custer Gallatin National Forest. However, the analysis area for individual species may be larger or smaller than the Forest, as described in the individual species sections. The Forest consists of two individual proclaimed national forests, which were combined in 2014 to be administratively managed as one national forest. The Forest is located in southern Montana and northwestern South Dakota and contains over 3.4 million acres within the Forest boundary. Of that, approximately 89 percent is National Forest System (NFS) lands, to which the Forest plan direction applies. The southwestern edge of the Forest abuts Idaho, and

stretches over 400 miles across southern Montana into the very northwestern corner of South Dakota. Custer Gallatin National Forest lands are administered in seven ranger districts, with offices located in Montana communities of West Yellowstone, Bozeman, Livingston, Gardiner, Redlodge, and Ashland, as well as Camp Crook, South Dakota. The Supervisor's Office is located in Bozeman, Montana, with an additional support center located in Billings, Montana. The Forest lies within eleven counties: Madison, Gallatin, Park, Meagher, Sweet Grass, Stillwater, Carbon, Rosebud, Powder River and Carter Counties in Montana, and Harding County in South Dakota.

The Custer Gallatin National Forest contains a large contiguous land mass at the northern end of the Greater Yellowstone Ecosystem, where the Forest abuts the northern and western boundaries of Yellowstone National Park. In addition, the Forest contains several smaller, isolated mountain ranges that are separated by private lands, valley bottoms, and highways. The multiple administrative units of the Forest span a vast area with high levels of ecological, social and economic diversity. Consequently, different parts of the Forest have their own unique characteristics and conditions, making certain places more ecologically suitable for certain species, as well as distinctive and recognizable to people. As such, the Forest plan identifies the distinguishable parts of the Forest as "geographic areas" (GAs). GAs identified in the Forest plan consist of distinct land masses of similar ecology coupled with a sense of place that has particular meaning to our publics.

The Greater Yellowstone portion of the Forest south of Interstate 90 was divided into two GAs at the Yellowstone River to create GAs of manageable size. These include the Madison, Henrys Lake and Gallatin Mountains GA to the west, and the Absaroka Beartooth Mountains GA to the east of the Yellowstone River. The Bridger, Bangtail and Crazy Mountains north of Interstate 90, are ecologically similar and in close proximity, and are grouped together as one GA. To the east, the Pryor Mountains and Ashland Ranger District are separate GAs, while the eight individual land units of the Sioux Ranger District in southeast Montana and northwest South Dakota are grouped into one GA. Ecologically, the Forest has termed its western, mountainous GAs (up to and including the Pryor Mountains) as the "montane ecosystem" and the eastern GAs (Ashland and Sioux) as the "pine savanna ecosystem." Figure 1 the six geographic areas, and table 2 displays the acres of the Forest by GA.

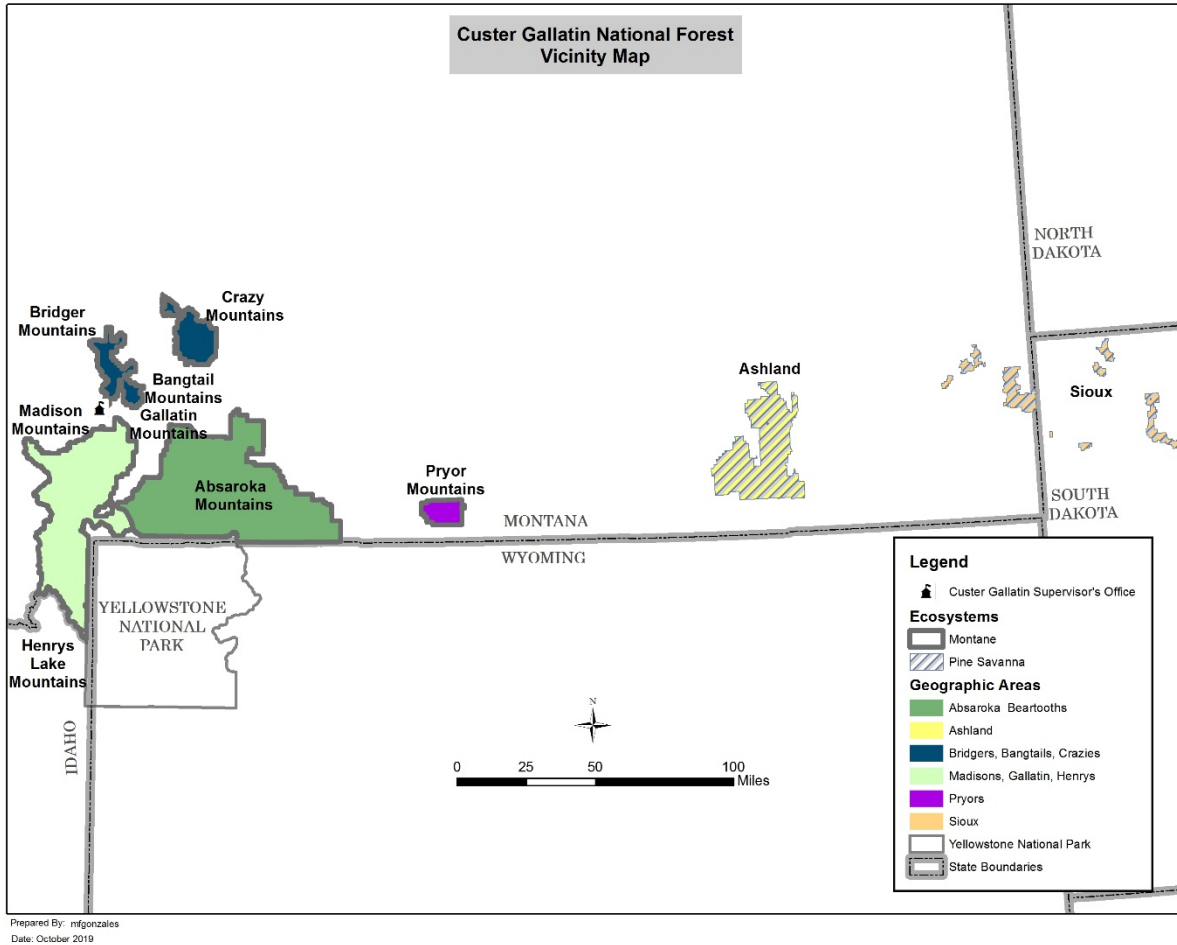


Figure 1. Custer Gallatin Forest Vicinity and Geographic Area

Table 2. Acres within the Geographic Areas of the Custer Gallatin National Forest

Geographic Area (GA)	Total Acres (All Ownerships)	National Forest System Acres within GA	% of GA in National Forest System Lands
Madison, Henrys Lake and Gallatin Mountains ¹	953,001	806,615	85
Absaroka Beartooth Mountains ²	1,387,707	1,358,541	98
Bridger, Bangtail and Crazy Mountains ³	314,598	205,148	65
Pryor Mountains ⁴	77,944	75,067	96
Ashland	501,797	436,134	87
Sioux	176,973	164,460	93
Totals	3,412,020	3,045,965	89

¹Abbreviated as "MHG"; ²Abbreviated as "AB"; ³Abbreviated as "BBC"; ⁴Abbreviated as "PM"

Forest planning framework

The 2012 Planning Rule

The United States Forest Service (USFS) carries out land and resource management planning under regulations referred to as the 2012 Planning Rule, that call for collaborative and science-based revision of forest plans. The 2012 Planning Rule requires forest plans to include certain types of components (see “Plan Components” section below) that must meet requirements within the rule for sustainability (36 CFR 219.8), plant and animal diversity (36 CFR 219.9), multiple uses (36 CFR 219.10), and timber (36 CFR 219.11).

In order to meet the requirements for plant and animal diversity, the rule calls for a complementary ecosystem and species-specific approach to forest management. Plan components must provide for ecosystem integrity and diversity by maintaining or restoring the structure, function, composition, and connectivity of ecosystems, and by maintaining key ecological characteristics (36 CFR 219.9(a)(1) and (2)). If those “coarse filter” components are not sufficient to provide conditions that will contribute to the recovery of federally listed threatened and endangered species, and conserve proposed and candidate species, then additional, species-specific plan components must be included (36 CFR 219.9(b)).

In addition to the above requirements, the 2012 Planning Rule contains several other requirements that shape the forest plan and therefore may influence Forest resources, including wildlife and habitats. The rule requires that forest plans identify:

- Lands suitable for inclusion in the National Wilderness Preservation System (36 CFR 219.7(c)(2)(v)), and/or rivers eligible for inclusion in the National Wild and Scenic Rivers System (36 CFR 219.7(c)(2)(vi))
- Existing designated areas and any additional areas recommended for designation (36 CFR 219.7(c)(2)(vii))
- Suitability of areas for appropriate integration of resource management and uses, including identifying lands not suitable for timber production (36 CFR 219.7(c)(2)(viii))
- The maximum quantity of timber that may be removed from the plan area (36 CFR 219.7(c)(2)(ix))
- Questions and indicators for monitoring (36 CFR 219.7(c)(2)(x) and the monitoring program itself (36 CFR 219.7(c)(3)(iii))
- Management areas and/or geographic areas (36 CFR 219.7(e))
- Watersheds that are a priority for maintenance or restoration (36 CFR 219.7(f)(i))
- Distinctive roles and contributions of the plan area to the broader landscape (36 CFR 219.7(f)(iii))
- Proposed and possible actions that may occur on the plan area during the life of the plan, including the planned timber sale program, timber harvesting levels, and the proportion of probable methods of vegetation management to be used (36 CFR 219.7(f)(iv))

Plan components

Plan components are specific statements that guide future projects and activities and the monitoring program in the plan area. Plan components may apply to the entire plan area (i.e., the entire CGNF NF), or to identified geographic or management areas (36 CFR 219.7(e)). The 2012 Planning Rule requires that forest plans include all the following types of components except goals, which are optional.

Desired Condition (DC) - a description of specific social, economic, and/or ecological characteristics of the plan area, toward which management of the land and resources should be directed. Desired conditions must be described in terms that are specific enough to allow progress toward their achievement to be determined, but do not include completion dates (36 CFR 219.7 (e)(1)(i)).

Goal (GO) –a broad statement of intent, other than desired conditions, usually related to process or interaction with the public or other agencies. Goals are expressed in broad, general terms, and do not usually include completion dates (36 CFR 219.7 (e)(2)). Goals may be dependent on conditions beyond the plan area or outside USFS authority.

Objective (OBJ) - a concise, measurable, and time-specific statement of a desired rate of progress toward one or more desired conditions. Objectives should be based on reasonably foreseeable budgets (36 CFR 219.7(e)(1)(ii)) and will occur over the life of the forest plan.

Standard (STD) - a mandatory constraint on project and activity decision-making, established to help achieve or maintain one or more desired conditions, to avoid or mitigate undesirable effects, or to meet applicable legal requirements (36 CFR 219.7(e)(1)(iii)).

Guideline (GDL) - a constraint on project and activity decision-making that allows for departure from its terms, so long as the purpose of the guideline is met. Guidelines are established to help achieve or maintain one or more desired conditions, to avoid or mitigate undesirable effects, or to meet applicable legal requirements (36 CFR 219.7(e)(1)(iii)).

Suitability of Lands (SUIT) - specific lands within the Forest are to be identified as suitable or not suitable for various multiple uses or activities, based on the desired conditions applicable to those lands. The suitability of lands need not be identified for every use or activity (36 CFR 219.7(e)(1)(v)). Identifying suitability does not make a specific commitment to authorize the use(s) identified, but is instead simply an indication that a type of use may be appropriate. Site, project, or activity-specific decision-making procedures must occur before a specific use is authorized in an area.

Plan components may apply forest-wide, or to specific geographic areas (GAs). Forest-wide direction applies across the Forest landscape, but may be applicable to specific, delineated areas, such as recommended wilderness areas. Forest-wide direction may also occur only in portions of the Forest where certain conditions are met; for example, where potential lynx habitat is present. Geographic area direction is specific to distinctive geographic areas, which are described in more detail in the Action Area description above. Geographic area components are those needed to address site-specific issues that are not adequately addressed by forest-wide direction. Plan components for threatened, endangered, proposed and candidate species are stated as forest-wide direction in order to account for dynamics of species' distribution. In other words, plan components for listed species generally apply wherever the species may occur on the Forest. The exception is where plan components apply only to a specific area for listed species, such as within the grizzly bear recovery zone.

Monitoring program

The 2012 Planning Rule requires development of a monitoring program to provide feedback for the planning cycle by testing relevant assumptions, tracking relevant conditions over time, and measuring management effectiveness (36 CFR 219.12). The monitoring program includes plan-level and broader-scale monitoring, and biennial monitoring evaluation reports document whether changes to the plan or to the monitoring program is warranted (36 CFR 219.5). See Chapter 4 of the “Revised Forest Plan for the Custer Gallatin National Forest” for the monitoring program. The entire revised plan is included as appendix 1 to the BA.

Planning directives

Procedural guidance for implementing the 2012 Planning Rule in revising forest plans is found in the Final Land Management Planning Directives (FSH 1909.12 – Land Management Planning Handbook) issued in January 2015. Chapter 20, Section 23 provides considerations and guidance for developing plan components that will provide for ecological sustainability and diversity of plant and animal communities. The planning directives are expected to be revised and updated periodically.

Description of the preferred alternative – alternative F

The 2012 Planning Rule adopts a complementary ecosystem and species-specific approach, known as a “coarse-filter or fine-filter approach,” to provide the natural diversity of plant and animal communities and ensure long-term persistence of native species in the plan area. The coarse filter aims to provide adequate representation (distribution and abundance) of ecological land units considering the historical range of variability based upon an understanding of the natural disturbance regimes of the ecological land units (Hauffer 1999). Coarse-filter plan components are designed to maintain or restore ecological conditions and processes for ecosystem integrity and diversity within agency authority and the inherent capability of the land. Fine-filter plan components are added for individual species (including federally listed species) to address needs that are not met through the coarse-filter components. Although many influences on natural landscapes are not easily controlled, the intent of plan components is to collectively provide for the full suite of native plant and animal diversity across the Custer Gallatin.

The 2012 Planning Rule anchors forest plans in desired conditions that are to be achieved through application of other plan components during forest management activities. The revised forest plan (Alternative F) includes components that guide management of a variety of resources and activities on the Custer Gallatin NF toward achieving desired conditions. Plan components prescribe management direction at both the forestwide scale and, where needed, specifically within a particular Geographic Area. Alternative F identifies the types of uses and management actions that would be allowed on the Custer Gallatin National Forest, by establishing land allocations such as recommended wilderness areas, backcountry areas, special emphasis areas and other designations where certain uses would be allowed or restricted. Alternative F also identifies lands suitable or not suitable for specific management actions such as timber production, permitted livestock grazing and others. Land allocations and suitability statements are plan components, and may be used to address coarse-filter, or fine-filter issues. For a complete list of plan components in the proposed action, see the revised forest plan (entire), in appendix 1 of this BA.

Figures 2-7 show revised plan geographic areas, designated areas and forest plan allocations.

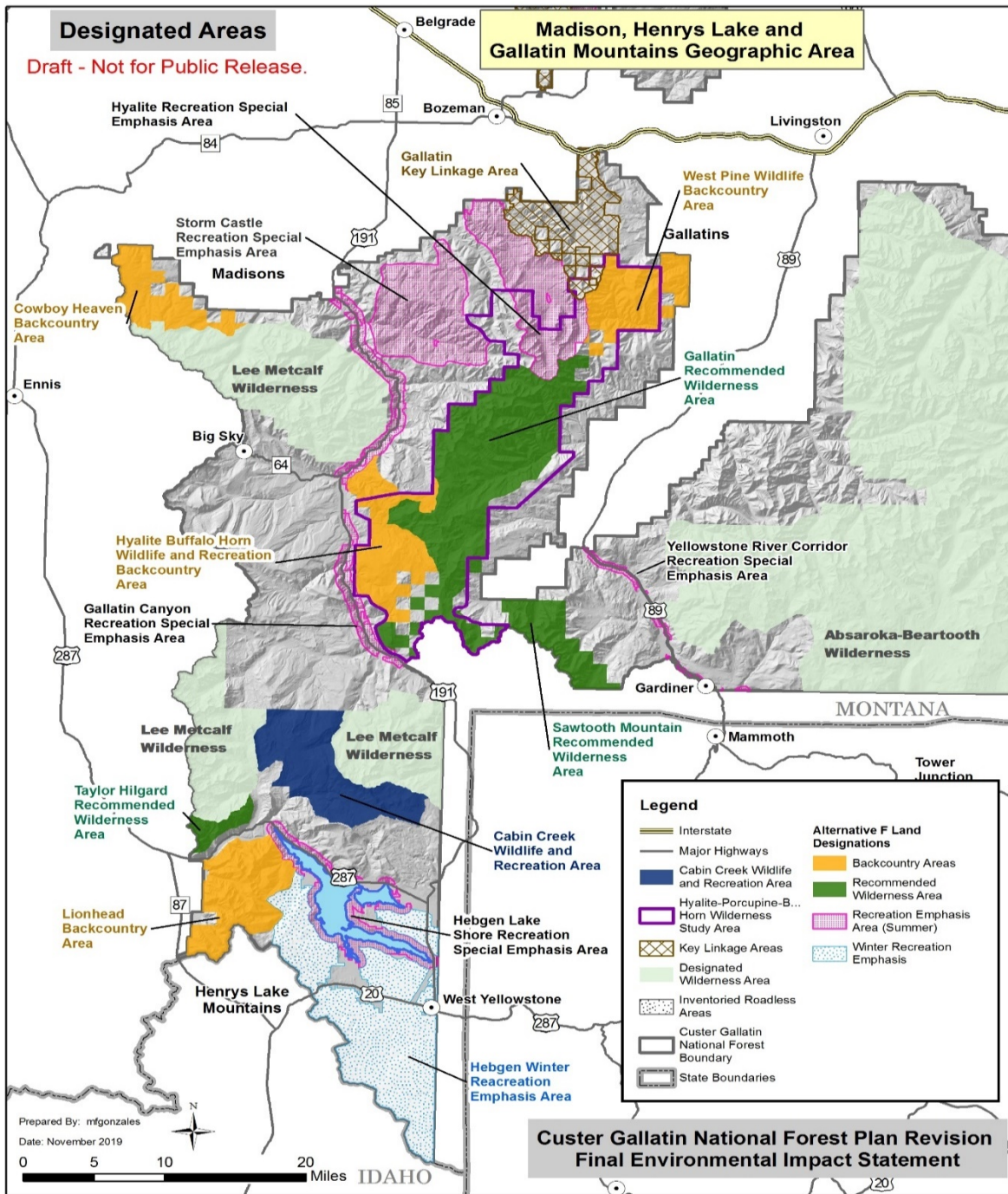


Figure 2. Forest Plan Allocations Madison, Henrys Lake and Gallatin Geographic Area

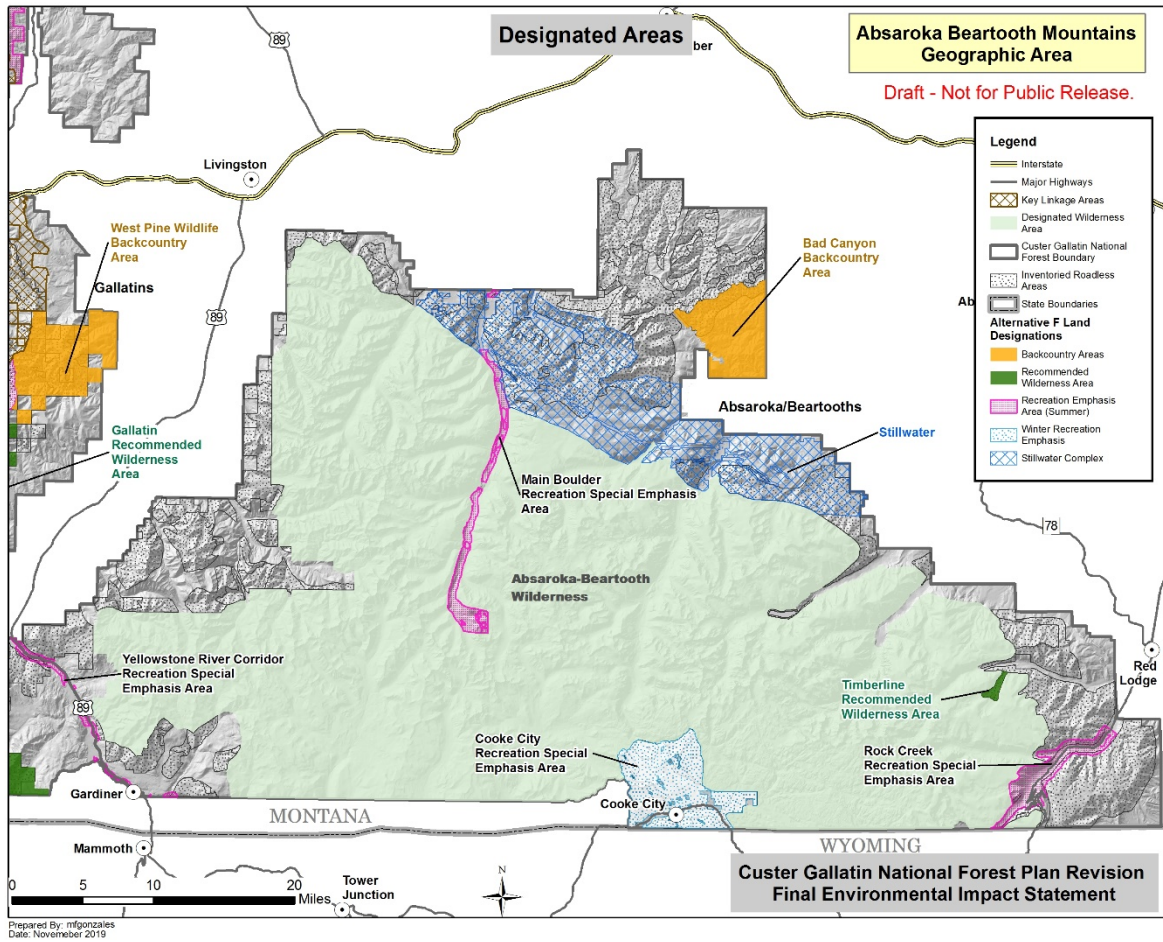


Figure 3. Forest Plan Allocations Absaroka Beartooth Geographic Area

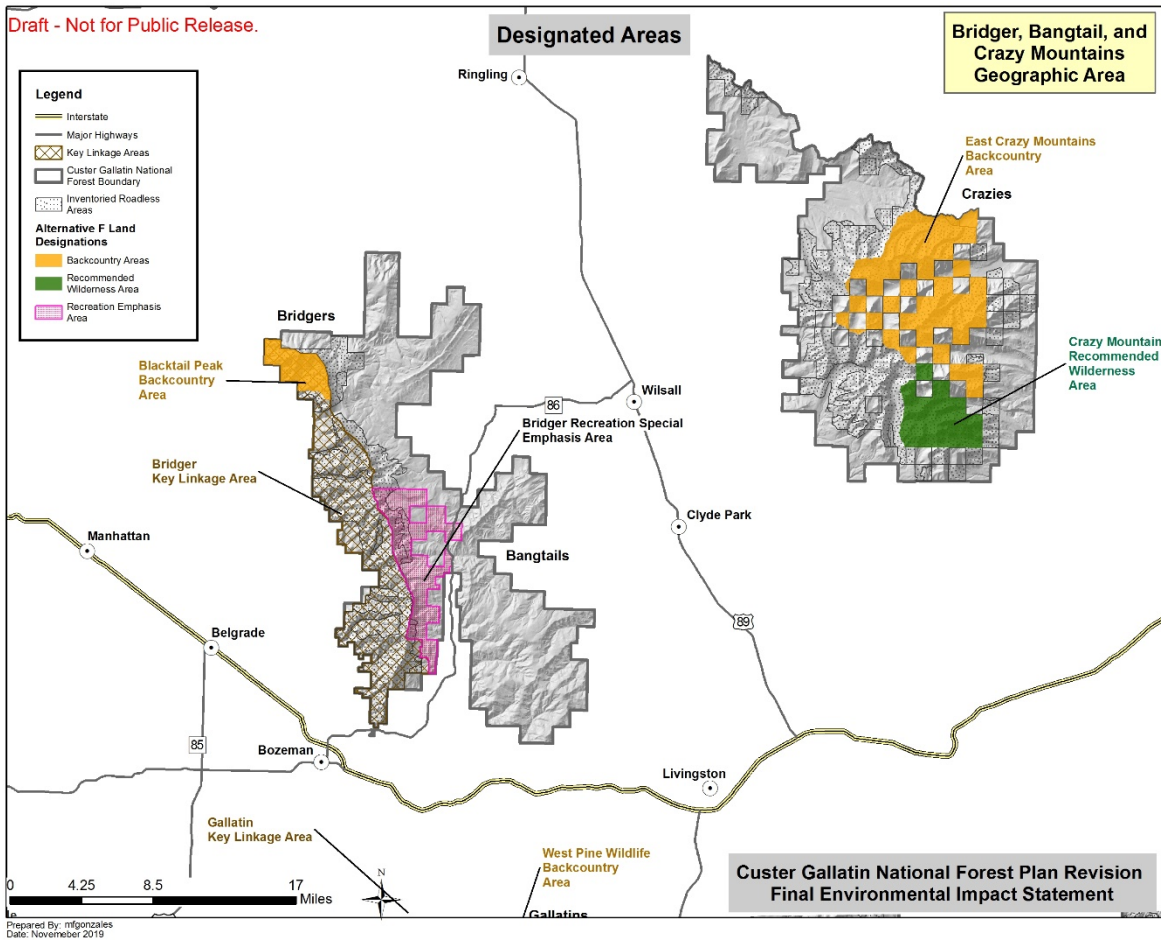


Figure 4. Forest Plan Allocations – Bridger, Bangtail, Crazy Mountains Geographic Area

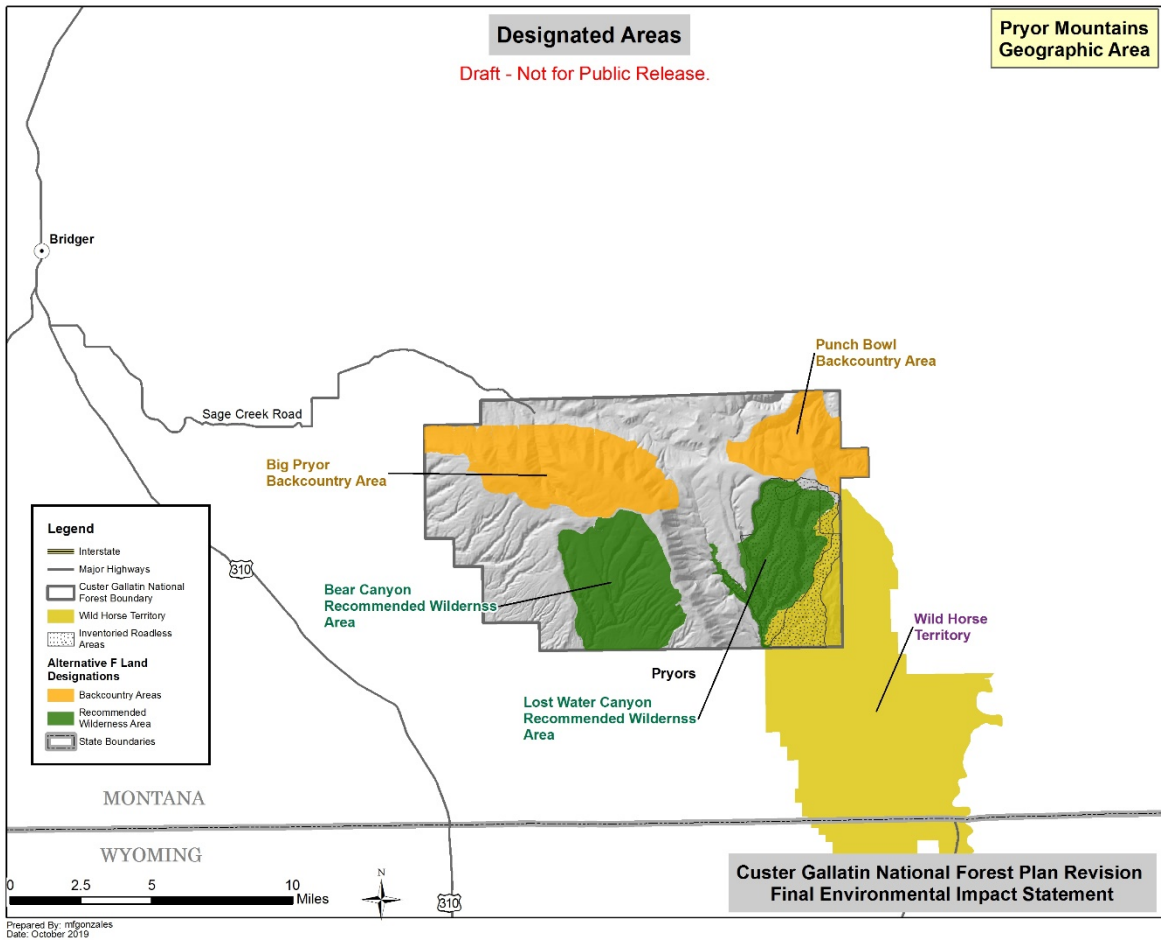


Figure 5. Forest Plan Allocations – Pryor Mountains Geographic Area

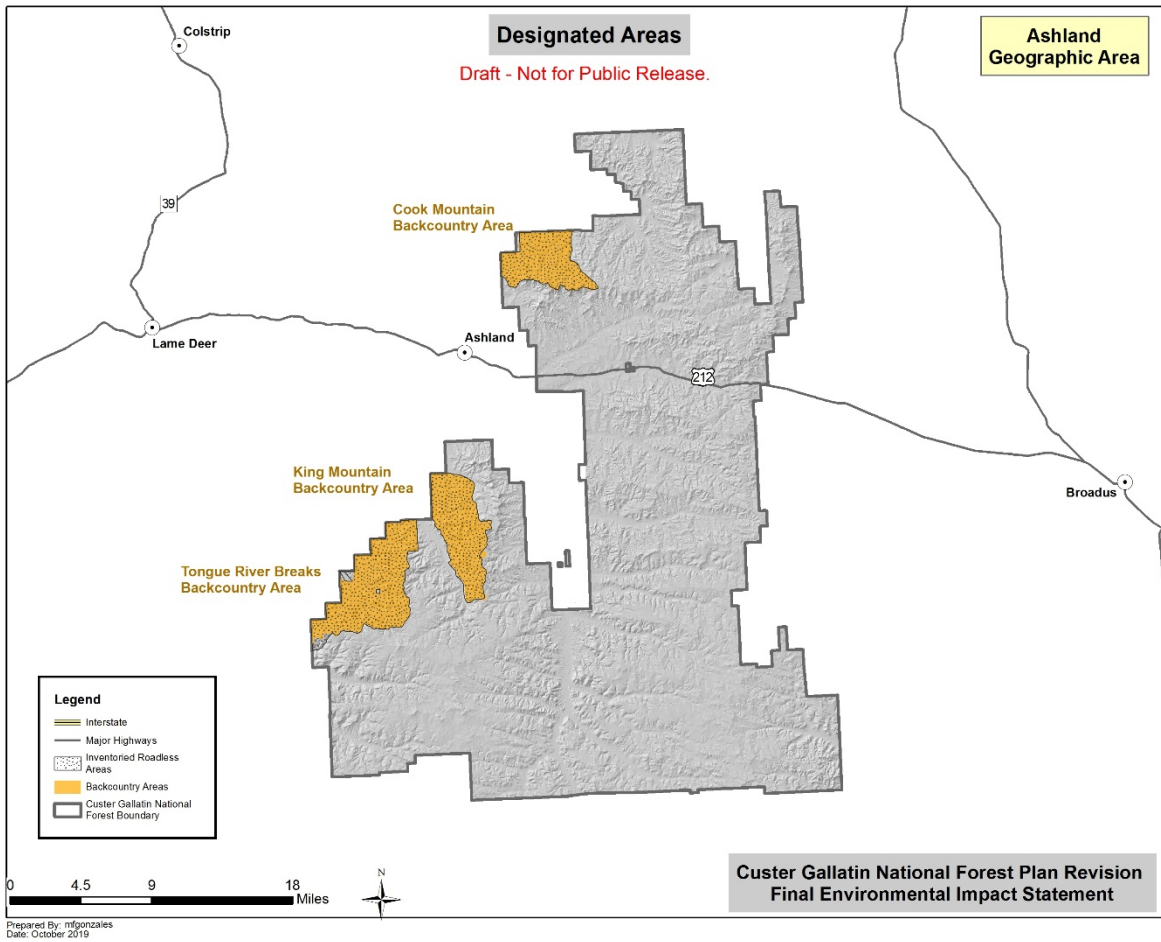


Figure 6. Forest Plan Allocations – Ashland Geographic Area

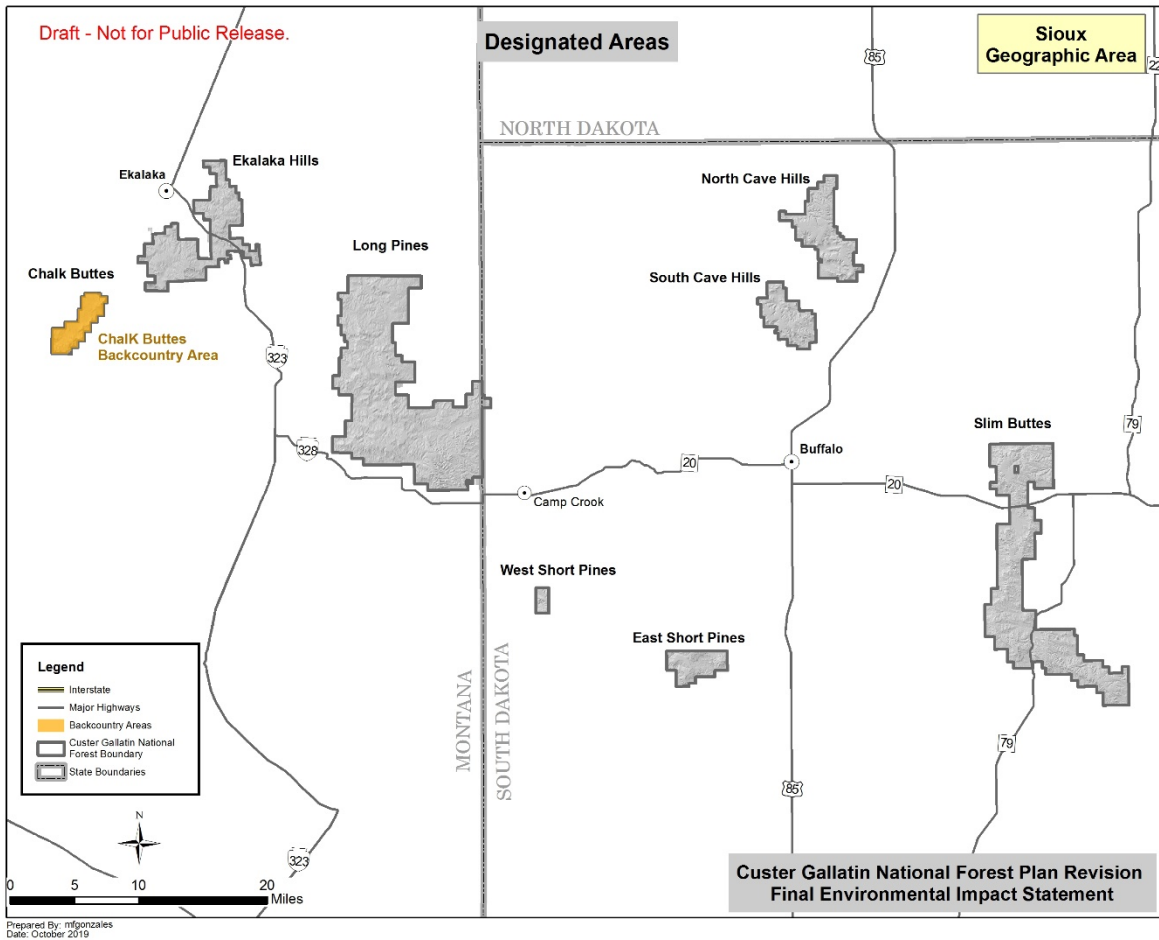


Figure 7. Forest Plan Allocations – Sioux Geographic Area

Species assessments

Analysis approach

The proposed action represents a programmatic decision that does not directly authorize any action, rather, it establishes the sideboards for allowable activities throughout the life of the plan, estimated at approximately 15 years from signing. As such, there would be no direct nor specific environmental consequences to listed species or their habitats associated with the proposed action. Analysis of the effects of this programmatic action therefore is based on the potential effects of implementing an overarching management program as a whole and is necessarily broad in its approach. On-going management actions and public uses resulting from implementation of existing plans may continue, and associated effects are included in the Environmental Baseline analysis for individual species. Future site-specific activities that occur as allowed by the proposed action could have direct effects to listed species or their habitat, but those can be predicted only after specific project proposals are developed. Site-specific analysis and required consultation for projects developed under the guidance of the proposed action will occur when those projects are planned and proposed. This BA addresses those factors that are affected by management on NFS lands, as guided by the programmatic direction in forest plans.

Terrestrial wildlife species

Whooping crane

Species status and ecological information

Population status and distribution

The whooping crane was listed as endangered in the United States in 1970, and “grandfathered” in under the ESA in 1973. Critical habitat was designated in 1978. The species was also listed as endangered in 1978 in Canada. An International Recovery Plan was developed for the species. The recovery plan was most recently revised in 2007, at which time the total wild population was estimated at 338 individuals. The species remains endangered in both countries due to low population size and limited range of the single remaining wild population. (CWS and USFWS 2005). Whooping cranes only occur in North America. They nest in Canada and winter along the central Gulf Coast of Texas. Spring and fall migrations occur through the central Great Plains of the U.S. (CWS and USFWS 2005).

Habitat requirements and life history

The whooping crane’s natural habitat includes marshes, estuaries, lakes, ponds, wet meadows and rivers. They follow the same pathway during spring and fall migrations. Spring migration typically occurs between mid-March and late May. Fall migration begins around mid-September and can continue through mid-November. During migration, whooping cranes travel singly, in small family groups or sometimes in larger groups including sandhill cranes (*Grus canadensis*). They regularly stop to feed and rest during migration. Whooping cranes are omnivores, and while their diets during migration are poorly documented, known food items include frogs, fish, plant tubers, crayfish, insects and agricultural grains. Much of the foraging occurs in harvested agricultural fields, while roosting typically occurs in marshy wetlands within a kilometer (0.6 mi) of a suitable foraging area. Single birds are more likely to forage in agricultural fields, whereas family groups forage more frequently in wetlands. Larger wetlands are likely preferred roosting habitat, but whooping cranes are known to use wetlands smaller than 0.5 ha (about 1 acre) in size (CWS and USFWS 2005).

Environmental Baseline

Population status and distribution in the action area

The Custer Gallatin National Forest is well outside the breeding and wintering areas for whooping cranes, and there is no critical habitat for the species located on the Forest. The Sioux GA (roughly 5 percent of the Forest land base), is the GA in closest proximity to the primary migratory pathway used by whooping cranes, and is the only area on the Forest where U.S. Fish and Wildlife Service (Bush 2019) indicated that the species may be present, although there have been incidental observations along the Yellowstone River (outside the Forest boundary) and near Hebgen Lake on private land, inside the Forest boundary (<http://mtnhp.org>).

Habitat conditions in the action area

There are no agricultural crops on NFS lands in the Sioux GA, but there are some marshy wetlands that could serve as suitable roosting and foraging habitat for migrating whooping cranes. Within the Sioux GA, vegetation modeling exercises predict that there are currently about 458 acres of riparian-associated habitat dominated by graminoid species, such as sedges and reeds. These areas represent

our best estimate of wetland habitats on the Forest that may provide suitable roosting and/or foraging areas for migrating whooping cranes. This estimate amounts to less than 1/3 of one percent of the NFS lands in the Sioux GA. Given that the Sioux GA covers only about five percent of the entire Forest, the amount of migratory stopover habitat for whooping cranes on the Forest is extremely limited.

Factors affecting whooping cranes

The whooping crane's natural habitat has been degraded by permanent conversions for agriculture, energy and other human developments (CWS and USFWS 2005). 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.

Effects of the proposed action on factors affecting whooping cranes in the action area

Whooping Crane Effects of the Proposed Action

The only geographic area with potential for whooping crane occurrence on the Custer Gallatin is the Sioux. This area is located in eastern Montana and western South Dakota and dominated by agricultural private lands surrounding parcels of higher elevation forested public land. These private agricultural lands represent the most suitable whooping crane roosting and foraging habitat on the GA. The distribution (highly dispersed), size (small patches), and total acreage of potential habitat patches limits their value. As stated previously to date there have been no observations of whooping cranes within the GA.

Given whooping crane habitat requirements and life history, actions and plan components that could potentially influence the condition of riparian and wetland habitat represent the most impactful to the species. There have been no documented observation of whooping cranes on the Custer Gallatin and the limited amount of potential suitable habitat suggests the chance of utilization by migrating individuals or groups is low. The primary threat to whooping crane habitat on Forest Service managed lands would be the degradation of wetland or riparian habitats through management actions. The proposed plan does not approve any action but establishes criteria all future projects must adhere to. The following discussion focusing on impacts from potential types of actions and the associated plan components that address those impacts.

General Plan Direction

In general forest management is looking to maintain a complete suite of native species in sufficient numbers and diversity that helps contribute to ecological processes (FW-DC-WL 01). For species such as whooping crane habitat conditions should contribute to recovery needs to keep population trends stable or increasing across the species range (FW-DC-WL 02). Maintaining vegetation conditions within the natural range of variation provides a situation in which habitats may contribute to multiple ecosystem needs and address seasonal requirements for a diverse suite of wildlife including whooping cranes (FW-DC-WL 03). The proposed plan is managing for ecologically resilient and sustainable successional stages (FW-DC-VEGF 03). Specific to riparian and wetland habitats species vegetation should provide breeding, feeding and sheltering opportunities along with connectivity and movement corridors for a wide-range of terrestrial, semi-aquatic and avian wildlife species (FW-DC-WTR 10). 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 whooping crane.

Effects from Watershed, Riparian, and Aquatic Management

The proposed plan contains coarse filter strategies to help maintain and restore habitat suitable as stopover sites for migrating whooping cranes within desired conditions for watershed, aquatic, and riparian ecosystems (FW-DC-WTR/RMZ All). Plan components provide more detailed guidance (FW-STD/GDL-WTR/RMZ All) compared to current plans for protection of watersheds, riparian areas, and aquatic habitats. The proposed plan adopts riparian management zones forestwide (FW-STD-RMZ 01). These zones would be greater in size than any riparian zones currently identified for streams on the east side of the Forest. 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 (FW-STD-RMZ 02).

Effects from Vegetation Management

Terrestrial desired conditions provide coarse filter plan components that would help maintain and restore potential migratory stopover habitats for whooping cranes. The revised plan includes desired conditions for native plant communities that are self-sustaining and diverse, and generally free of non-native species (FW-DC-VEGNF 01, 02). This includes specific and detailed descriptions of grasslands, wetlands and riparian habitats (FW-DC-VEGNF 04), that would help guide future management toward maintenance or restoration of structure, function and/or vegetation composition characteristics that could provide suitable habitat for migrating whooping cranes. Guidelines would help minimize future impacts to important wetlands and grassland habitats by limiting developments that could fragment intact grasslands or impact sensitive wetlands (FW-GDL-VEGNF 03-05).

Effects of Fire and Fuels Management

The proposed plan includes desired conditions and objectives for wildland fires within the natural range of variation to maintain resilient ecological conditions (FW-DC-FIRE 01, FW-OBJ-FIRE 02), which would support natural disturbance processes that maintain healthy grassland and wetland communities, contributing to plant and animal diversity that would provide suitable foraging and resting conditions for whooping cranes. Plan components contain desired conditions for minimal detrimental impacts to values at risk from wildland fire (FW-DC-FIRE 02, 03), with associated plan components to minimize such risk (FW-OBJ-FIRE 01, FW-STD-FIRE 01, FW-GDL-FIRE 02). Hazardous fuel reduction operations and fire suppression activities can alter natural vegetative conditions in ways that could impact resting and foraging habitat for Whooping cranes. Minimum impact suppression tactics would be used to minimize damage to wetland and riparian habitats from wildland fires (FW-GDL-FIRE 03) and riparian management zone components would add further protection with restrictions on vegetation management (such as fuel reduction), refueling activities, and temporary fire facilities (FW-STD-RMZ 02, 04; FW-GDL-RMZ 02).

Effects of Timber Management

The proposed plan includes desired conditions for timber harvest that contributes to ecological integrity and sustainability while also contributing to economic sustainability, providing jobs and product to local communities (FW-DC-TIM 01). Vegetation management has the potential to reduce the quality of whooping crane habitat through removal of forested structure within or near wetland and riparian areas. Riparian management zones, which include buffers around wetlands, fens, and seeps (FW-STD-RMZ 01), are not suitable for timber production, salvage harvest, or firewood gathering (FW-SUIT-RMZ

01, 02). Timber would not be harvested on lands where soil, slope or other watershed conditions may be irreversibly damaged by harvest activities, as identified in project specific findings (FW-STD-TIM 02). Vegetation management within the inner riparian management zones would only be allowed for the purpose of restoration or enhancement of aquatic and riparian associated resources (FW-STD-RMZ 01). These plan components would prevent the alteration of potential whooping crane habitat through timber harvest unless for the express purpose of restoration or enhancement of the wetland community.

Effects from Chemicals, Pesticides, toxicants

Wetland and riparian communities can be highly susceptible and sensitive to the presence of chemical pollutants. Use or contamination within these systems may result in the degradation of habitat condition for whooping crane by reducing forage quality and abundance. Whooping cranes are omnivores, and while their diets during migration are poorly documented, known food items such as fish, amphibians, insects and crayfish can be highly sensitive to the presence of chemicals. Reducing the availability of these forage species directly impacts habitat quality for whooping cranes. It is important to note that the proper use of chemical agents may represent an important tool in the management of other ecosystem threats such as invasive weeds and insects and disease. The proposed plan provides restrictions regarding the use of pesticides, toxicants, other chemicals, and refueling activities in order to protect these sensitive and important habitats (FW-STD-RMZ 03, 04). These tools would only be applied within riparian management zones if needed to maintain, protect, or enhance aquatic and riparian resources or to restore native plant communities (FW-STD-RMZ 02). These components would protect or improve foraging habitat conditions in areas that may serve as migratory stopover points for whooping cranes.

Effects from Permitted Livestock Grazing Management

The proposed forest plan contains a desired condition that grazing allotments supply livestock forage and contribute to local ranching operations, while maintaining or moving toward desired ecological conditions (FW-DC-GRAZ 01). Livestock often congregate within wetland and riparian habitats during the grazing season. Over utilization of these locations has the potential to degrade the vegetative community and structure and function of the system (Rich et al. 2004). Proper grazing management is necessary to retain healthy riparian and wetland systems for the benefit of species such as whooping crane. The proposed plan contains a number of plan components to protect riparian and upland habitats from undue pressure from domestic livestock grazing. These include a goal to work with permittees to remove allotment infrastructure that may attract livestock use in riparian areas or wetlands (FW-GO-GRAZ 01). New or revised allotment management plans would include provisions to maintain or improve resiliency of riparian and upland ecosystems (FW-STD-GRAZ 01). Grazing-specific guidelines contain measures to maintain or improve stream habitat, water quality, and riparian habitat, protect sensitive areas from grazing pressure, and ensure plant community health with specific, quantifiable forage utilization measures within riparian areas (FW-GDL-GRAZ 01, 02, 04, 05). Finally, riparian management zone components restrict livestock management activities such as permanent livestock handling facilities, watering structures, and trailing routes within buffers around wetlands (FW-GDL-RMZ 01). Collectively these plan components would minimize grazing management impacts to potential whooping crane foraging and resting areas.

Effects from Land Use Allocations

The proposed Forest Plan designates several land use allocations throughout the plan area. In addition to existing designations such as Wilderness and Inventoried Roadless areas the Forest proposes the addition of three new categories recommended wilderness areas, backcountry areas, and recreation emphasis areas. These designations differ in the desired management conditions and consideration which is reflected in the associated plan components. These land use allocations have the potential to impact wildlife habitat through the control of certain types of use pattern and activities. Within the Sioux GA the Proposed Action includes a single backcountry area designation located in the Chalk Buttes. The proposed Chalk Butte backcountry area has the potential to impact suitable habitat for whooping cranes. Proposed BCA locations can be seen in Figure 7. There are small wetlands and riparian areas within the Chalk Buttes which could represent potential stopover or foraging habitat. However, this area is located at the very edge of the migratory flyway used by whooping cranes, and outside of the area where the species may be present (Bush 2019). This fact limits potential benefits of the BCA designation. Despite the limited potential for use by whooping cranes the designation of BCAs may have a positive benefit to habitat and use through the development restrictions associated with the plan component standard (FW-DC-BCA 01, FW-STD-BCA 02). These restrictions will prevent the removal or modification of habitat associated with these type of actions and reduce the level of human use concentration thereby reducing the potential for disturbance of migrating individuals or groups. Motorized and mechanized recreation would continue to be allowed on routes open to such uses.

Effects from Energy and Minerals Management

Mineral and energy development actions have the potential to impact suitable whooping crane habitat through adverse effects on aquatic and riparian resources. Leaching of chemicals and pollutants from drainage, physical disturbance, and continuous human presence are some of the potential impacts to whooping cranes and their habitat. The proposed plan addresses such concerns by stating mineral and energy development activities include provisions to reclaim disturbed areas (FW-STD-EMIN 01) and minimize effects to aquatic and riparian resources from mineral and energy development (FW-GDL-EMIN 02). The extraction of saleable mineral materials would not be allowed in riparian management zones (FW-STD-RMZ 05). Finally, plan components include a provision for wind energy developments to minimize impacts on birds (FW-GDL-WL 07), which would reduce risk of migrating whooping crane collisions with wind turbines.

Effects from Infrastructure Management

Infrastructure typically associated with visitor use has the potential to effect riparian and wetland systems and associated whooping crane habitat through the discharge of wastewater, introduction of invasive species and general degradation of these areas. Under the proposed plan, 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 (FW-DC-RT 01; FW-STD-RT 01-05). In order to protect the condition of riparian areas and avoid the degradation of unique habitats permanent and temporary facilities, buildings, and other structures should not be located or developed within riparian management zones and woody draws (FW-GDL-FAC 01-03; FW-GDL-RMZ 02, FW-GDL-VEGNF 04, 05). Road and transportation infrastructure may represent a potential mechanism for degradation of suitable whooping crane habitats. To address this concern the plan includes several components for infrastructure such as roads, trails and other facilities to minimize impacts to aquatic and riparian habitats and limit disturbance to associated species (FW-STD-RT 01-05). Standards address new road

construction preventing impact in function and sediment delivery (FW-STD-RT 03, 04). There are several guidelines that establish practices such as avoidance, bank stabilization, retention of natural hydrological regimes, and connectivity of these systems for the benefit of associated species (FW-GDL-RT 03-06, 09). Adherence to the standards and guidelines set forth in the proposed plan impacts typically associated with infrastructure would be negligible to whooping cranes and their habitats.

Effects from Recreation Management

The proposed plan highlights the importance of recreation resources on the Custer Gallatin (FW-DC-REC 01-03), but also includes desired conditions for recreation uses and developments to have minimal impacts on ecological integrity, at-risk species, water quality and aquatic species (FW-DC-REC 05) and include an objective to remove or relocate some existing recreation facilities out of riparian areas (FW-OBJ-REC 01). The proposed plan would include desired conditions for recreation facilities to have minimal impacts on threatened and endangered species, as well as overall compatibility with natural resources (FW-DC-DEVREC 02). New developed sites would be designed to replace existing dispersed sites that are degrading riparian resources (FW-DC-RECDEV 07). Plan components address construction and maintenance of new and existing recreation facilities such as boat ramps, docks and interpretive trails within or near riparian areas (FW-GDL-FAC 03, 04). This will result in the protection of species such as whooping crane and their migratory habitats from impacts associated with recreation management.

Cumulative Effects

Cumulative effects under the Endangered Species Act include state, Tribal, local or private actions that are reasonably certain to occur within the action area for whooping crane. Approximately 12513 acres of state, county, city, and privately-owned lands fall within the boundaries of the Custer Gallatin National Forest in areas where whooping crane may be present. This Non-federal ownership accounts for about 7% percent of all lands with potential habitat within the CGNF boundary. Surrounding non-federal lands typically contain lower levels of forested habitat and a greater potential for suitable habitat for whooping cranes relative to National Forest System lands. Human activities on non-federal lands are more likely to have potential impact on habitat suitability than federal actions. Since the Forest Plan is a programmatic document that does not mandate, authorize or approve any site-specific projects or actions, it has no direct effects on whooping crane, but could have indirect effects as future projects and activities are planned, approved and implemented in compliance with the revised plan. Therefore, cumulative effects may result with ongoing and future actions allowed or implemented under land management plans for non-federal lands.

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 whooping crane as a species of greatest conservation need. However, Montana has identified aquatic community types of greatest conservation need that have potential to provide habitat for whooping cranes. These communities include prairie rivers, lakes and reservoirs, and mixed systems. In the Wildlife Action Plan the state identifies potential threats to these systems such as habitat fragmentation, pollution, and development. The state plan sets forth recommendation for how to manage and address the potential threats.

The South Dakota State Wildlife Action Plan identifies whooping crane as a species of greatest conservation need. The State Wildlife Action Plan only shows occupancy on the eastern most portions of the Sioux GA. The action plan identifies conservation actions such as minimizing the risk of collisions

with utility lines and habitat degradation. In addition, the action plan recommends working with agencies to develop programs and materials to reduce illegal shooting and develop programs to protect staging/migrating birds. These conservation actions are compatible with plan components contained in the proposed forest plan.

Community Wildfire Protection Plans (CWPP) are collaborative agreements between local governments, fire departments, and State forest management agencies in consultation with Federal land management agencies and other interested parties. CWPPs identify and prioritize areas needing hazardous fuel reduction on Federal and non-Federal lands to protect at-risk communities and essential infrastructure. CWPPs may assist State, local and private landowners by identifying areas in greatest need of fuel reduction treatment as well as recommending effective and efficient measures to reduce the chance that wildfire will ignite structures on their property (USDA FS 2004). Within the Sioux GA CWPPs could encourage non-federal landowners to conduct fuel treatment projects in potential whooping crane habitat temporarily or permanently altering habitat quality. This is unlikely to represent a severe threat to whooping crane habitat given the general lack of fuels management actions on non-federal lands in the Sioux GA. All Montana and South Dakota counties located in the geographic areas with potential for whooping crane presence currently have CWPPs. Approximately 28% of the Sioux geographic area falls under a CWPP.

Whooping cranes are not currently known to occur on the Custer Gallatin National Forest, and would only occur during seasonal migrations. Most cumulative impacts to this species results from impacts occurring on breeding or wintering grounds in locations beyond the management jurisdiction for the 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, whooping cranes are federally listed as 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.

Determination of Effects

This biological assessment analyzes the potential impacts to whooping crane through implementation of the programmatic Custer Gallatin National Forest revised land and resource management plan. Impacts to whooping cranes and their habitat have been considered in the context of factors that may influence survival and habitat use. The Forest has made the determination that implementation of the proposed Forest Plan *may affect but will not likely adversely affect* whooping cranes. Effects of the programmatic

are insignificant and/or discountable due to plan components that guide potential forest actions with consideration given effects on individuals and habitat:

- Vegetation management actions will not occur within potential riparian and wetland habitats unless it is for the specific purpose of restoration or enhancement of the system (FW-STD-RMZ 02)
- The use of pesticides, herbicides, toxicants and other chemicals will only be allowed within riparian management zones if needed to maintain, protect, or enhance aquatic and riparian resources or to restore native plant communities (FW-STD-RMZ 03)
- Allotment management for livestock should be designed to minimize sediment delivery, maintain stream habitat and water quality in riparian areas (FW-GDL-GRAZ 01)
- Habitat conditions should contribute to recovery needs to keep population trends stable or increasing across the species range (FW-DC-WL 02)
- Timber shall not be harvested on lands where soil, slope or other watershed conditions may be irreversibly damaged by harvest activities, as identified in project specific findings (FW-STD-TIM 02)
- Newly constructed or reconstructed roads shall not encroach into streams and riparian management zones in ways that impact channel and floodplain function, geometry, or sediment delivery in the long term (FW-STD-RT 04).
- To protect wetlands and to protect the roadbed, wetlands and unstable areas should be avoided when reconstructing existing roads or constructing new roads and landings. Impacts should be minimized where avoidance is not practical (FW-GDL-RT 09).

Northern long-eared bat

Species status and ecological information

Population status and distribution

The northern long-eared bat was listed as threatened in 2015 in response to dramatic population declines due to white-nose syndrome. In survey sites affected by white-nose syndrome, northern long-eared bat counts have declined on average 96 percent, and the species is considered extirpated from parts of its range. Northern long-eared bats range across eastern and north-central U.S., to the eastern edge of Montana. However, the species is less common, or even rare at the western edge of its range (USDI FWS 2015).

The Forest is aware of the recent District Court decision to remand the decision to list the Northern Long eared bat as Threatened. The current threatened status was not vacated by the court (*Center for Bio. Div. v. Everson* 15-cv-477 2020). The USFWS will likely review and complete a new listing decision. Until this process is complete the current threatened status remains in effect.

Habitat requirements and life history

Northern long-eared bats spend summer in deciduous and coniferous forest. Pine or deciduous forests may be used by maternity colonies, which typically select trees between 4 and 10 inches in diameter for maternal roosts. Males and non-reproductive females may also roost in cooler sites such as caves or mines if available (USDI FWS 2015). The majority of summer roosts for this species have been found in hardwood tree species in eastern North America. In general, northern long-eared bats appear to prefer intact mixed-type forests with small gaps (*i.e.*, forest trails, small roads, or forest-covered creeks) in forest with sparse or medium vegetation for forage and travel rather than fragmented habitat or areas that have been clearcut (USDI FWS 2016). Where roosts have been found in coniferous forests, most have been in snags rather than live trees (Perry and Thill 2007). Northern long-eared bats have been known to use ponderosa pine snags for roost trees in the Black Hills of South Dakota (Cryan et al. 2001). However, most studies suggest that hardwood trees are most likely to provide the characteristics of roost sites preferred by maternity colonies. An insectivore, the northern long-eared bat feeds on moths, flies, beetles and other insects, capturing them in flight or picking them off vegetation. Most foraging occurs in forested areas below the canopy, but also in small openings, near water, and along roads. The northern long-eared bat hibernates in caves, mines and other structures in winter. Typical hibernacula for the species include large caves with large entrances and passages. Hibernating bats are often found in areas of highest humidity within these caves (USDI FWS 2015). Critical habitat for northern long-eared bats has been neither proposed nor designated (USDI FWS 2016).

Environmental Baseline

Population status and distribution in the action area

The Fish and Wildlife Service has determined that the northern long-eared bat may be present in the Sioux and Ashland GAs of the Forest (Bush 2019); however, the species has not yet been documented to occur anywhere on the Forest (Deisch 2018 pers. comm., Skone 2019 pers. comm., Bachen 2019). In 2005, bats resembling the northern long-eared species were captured in mist-netting operations conducted in the Sioux GA; however, no DNA samples were taken. Since the northern long-eared bat is morphologically similar other bat species including the little brown bat (*M. lucifugus*) and the long-eared myotis (*M. evotis*), they can be difficult to distinguish on physical characteristics alone. Therefore, these observation records for the Sioux GA are considered provisional and the identification to species is noted to be questionable (<http://mtnhp.org>).

Habitat conditions in the action area

The Sioux and Ashland GAs are dominated by ponderosa pine forests. Since 2012, numerous large and small wildland fires have produced an abundance of snags, mostly in the Ashland GA. In addition to green and burned ponderosa pine trees, there are smaller inclusions of deciduous trees, most notably cottonwood, aspen and green ash, found along streams and in woody draws. Live and dead trees provide potential summer roost sites, and even possible maternal roost sites for northern long-eared bats. Rimrock cliffs in the area are riddled with cracks, crevices and small holes, and there are a number of small, generally shallow caves in the Sioux and Ashland GAs that could also provide suitable summer roosting habitat for northern long-eared bats. Caves in the Sioux and Ashland GAs are primarily wind-formed. They typically do not contain extensive passageways, and are generally dry (*i.e.* they lack hydrologic features and maintain low humidity). Foraging habitat for northern long-eared bats occurs under the canopy of ponderosa pine forests, although recent wildland fires have reduced the amount of

closed-canopy forest in the Ashland and Sioux GAs. Foraging habitat is also available in woody draws and riparian areas, which are relatively minor habitat components on the Ashland and Sioux GAs.

Only two small caves are known in the Ashland GA. While there are numerous small caves in portions of the Sioux GA, there are no known large caves, underground mines (abandoned or active), or other features present in the Ashland or Sioux GA that might serve as suitable winter hibernacula for northern long-eared bats. There are, however, 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. Subsequently, a bat (though not a northern long-eared bat) with white-nose syndrome was found 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 and Ashland GAs (Powder River and Carter Counties, Montana, and Harding County, South Dakota) are now within the white-nose syndrome zone (USDI FWS 2018).

Factors affecting northern long-eared bats

The primary threat to the northern long-eared bat is from white-nose syndrome, which primarily affects bats in their winter hibernacula. The northern long-eared bat appears to be one of the most highly susceptible species to this disease. 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 2015).

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 2015).

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 (USDI FWS 2015).

Effects of the proposed action on factors affecting Northern long-eared bats in the action area

Effects from Disease

Transmission and spread of white-nose syndrome (WNS) constitute the greatest threat to bat populations on the Custer Gallatin National Forest including the northern long-eared bat (NLEB). 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).

There are currently no known NLEB hibernacula on the Ashland and Sioux Geographic Areas (GA) and potential habitat is limited. 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. This may limit the potential for spread of WNS but creates a situation where arrival of WNS may have a substantial impact on the small NLEB population if present.

Several plan components are designed to minimize the risk of WNS transmission so that key habitats are free of disease (FW-DC-WLBAT 01). While the primary method of WNS transmission is bat to bat contact human facilitated transmission remains a possibility. Human activity can also result in noise and disturbance that may impact bats at summer roosts as well as in hibernacula. Disturbance of bats infected with WNS can often be fatal (USDI FWS 2015). The Forest intends to continue engagement with other agencies and interested parties in the development in implementation of WNS prevention and response guidelines (FW-GO-WLBAT 01). This goal acknowledges ongoing work to survey for bat presence, detect the fungus responsible for white-nose syndrome, take measures to reduce the spread and eradicate this fungus, continue research and educate Forest visitors about the importance of proper decontamination procedures. Many known caves on the Forest with characteristics of bat roosts or hibernacula have been surveyed for bat presence. Additional cave inventory and survey work has been underway in recent years. The Montana Natural Heritage Program has been surveying and monitoring for bats on a statewide basis through an agreement with the Forest Service (Bachen 2019). Cooperative cave inventory and bat survey/monitoring efforts are expected to continue consistent with the monitoring plan (MON-WL-05). This collaborative effort represents the most effective way to monitor and prevent the spread of WNS. The proposed plan requires all agency personnel and other authorized users such as contractors and volunteers to utilize established decontamination procedures prior to entering and upon leaving caves or abandoned mines known to be used as roost sites or winter hibernacula (FW-STD-WLBAT 01). This requirement is consistent with the 2018 Montana WNS Prevention and Response Guidelines to ensure the latest washing and decontamination protocols are being followed. In order to reduce the risk from other public uses new developed recreation sites and other features that concentrated human use will be placed at least one-half mile from any known hibernacula or roost site (FW-GDL-WLBAT 03). Limiting proximity reduces the potential for human contact and subsequent potential disease transmission and/or disturbance of roosting or wintering bats.

Disturbance of bats infected with white-nose syndrome can be fatal (USDI FWS 2015). Plan components include measures to minimize human disturbance of bats not only at winter hibernacula, but at maternity and general roost sites as well (FW-GDL-WLBAT 02-05). These measures would reduce the risk of bat mortality associated with disturbance or 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.

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 2015).

Effects from Terrestrial Vegetation 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 2015). Mechanical harvest for timber production would be allowed only on those National Forest System lands classified as suitable for timber production. Within the Ashland and Sioux GAs potential suitable base acres for vegetation management that have been identified total 186,299 (Ashland) and 56,799 (Sioux). These values are lower than suitable based acres identified in the current plans of 196,126 (Ashland) and 65,959 (Sioux). This represents a maximum estimate of management activity with actual on the ground implementation levels likely resulting in fewer acres impacted.

Incidental take may result from the physical alteration of hibernaculum entrances or environments when bats are not present provided that alteration would result in changes to essential behavioral patterns. The most important conservation actions are the protection of hibernacula and maternal roost trees (USDI FWS 2016). In order to address these conservation considerations and avoid incidental take the proposed plan sets forth two key guidelines. To reduce the impacts of vegetation management activities on roosting bats the proposed plan requires trees within 150 feet of known maternal roosts to not be removed through management activities in order to retain future roost locations (FW-GDL-WLBAT 02). Also, any mechanical removal of trees or prescribed fire activity is restricted within 0.25 miles of known hibernacula unless necessary for the protection of human life or property or would result in direct benefits to bat habitat (FW-GDL-WLBAT 01). Research has shown that removal of adjacent vegetation may not result in any significant change to hibernacula microclimate (Davis et al 2000). However, late summer and fall swarming behavior may result in a concentration of use adjacent to hibernacula (USDI FWS 2016). The intent of these guidelines is to retain suitable forage and roosting habitat adjacent to known hibernacula and protect spatial extent and potential alternate entrances. These plan components are consistent with recommendations outlined in the final 4(d) rule regarding the prevention of incidental take. By adopting these recommendations as plan components maternal roost trees, hibernacula and the surrounding habitat would be protected from the effects of physical alteration of habitat and will conserve essential behavioral patterns. These guidelines are also consistent with the 2018 Montana WNS Prevention and Response Guidelines to protect or restore winter roost habitat, including caves, mines, rock outcrops and other habitats.

Vegetation management plan components include direction for the retention of snags and large live trees in timber harvest projects to maintain or move toward desired conditions that reflect a natural range of variation (FW-GDL-VEGF 03-05). Following these guidelines would provide snags and large live trees for roosting bats, with an emphasis on leaving the largest trees and snags, which are preferred roost sites for bats (USDI FWS 2015).

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 2015). The proposed plan includes 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 (FW-DC-FIRE 01, FW-DC-FIRE 02, and FW-GDL-FIRE 01). In addition, tree removal through prescribed fire actions is prohibited within 0.25 miles of known winter hibernacula (FW-GDL-WLBAT 01). Effects of this guideline are similar to those discussed in the vegetation management section. Plan components for bats would preclude the use of prescribed fire near known occupied bat maternal roosts during the pup season (FW-GDL-WLBAT 02).

Land use Allocations

The proposed Forest Plan designates several land use allocations throughout the plan area. In addition to existing designations such as Wilderness and Inventoried Roadless areas the Forest proposes the addition of three new categories recommended wilderness areas, backcountry areas, and recreation emphasis areas. These designations differ in the desired management conditions and consideration which is reflected in the associated plan components. These land use allocations have the potential to impact wildlife habitat through the control of certain types of use pattern and activities. Within the Ashland and Sioux Geographic Areas the Proposed Action includes only Backcountry Area designations and no recommended wilderness areas, or recreation emphasis areas. Backcountry areas are to be managed as generally undeveloped or lightly developed areas that have none or few primitive roads. Within BCAs natural processes are allowed to play their role and human use leaves little permanent or long-lasting evidence (FW-DC-BCA 01). Specifically, development of new energy/utility corridors, commercial communication sites, developed recreation sites, permanent roads, or extraction of saleable miner materials is prohibited (FW-STD-BCA 01). Proposed backcountry area locations can be seen in Figures 6 and 7.

These backcountry areas include potential habitat for NLEB primarily consisting of roost habitat associated with live trees and snags. There are no known hibernacula within the proposed backcountry areas. Backcountry area allocation may have a positive benefit to NLEB habitat through the development restrictions associated with the plan component standard. These restrictions will prevent the removal or modification of habitat associated with these types of actions and reduce the level of human use concentration thereby reducing the probability of disease transmission. For example, within both geographic areas the desired condition is to provide areas for less developed semi-primitive recreation and manage non-motorized and, in the case of the Sioux, motorized access and use (SX-DC-CBCCA 01; AL-DC-ABCA 01). Specifically, within the Ashland geographic area new permanent or temporary roads and trails are not allowed in the backcountry areas (AL-STD-ABCA 01, 02). Within the Sioux geographic area backcountry area motorized use and temporary road construction is allowed but there will be no new permanent roads (SX-STD-CBCCA 01).

Effects from Permitted Livestock Grazing

Livestock grazing practices typically do not directly affect NLEB roost or hibernacula habitat. However, the presence of developed water features on the landscape may result in a potential positive benefit by providing foraging locations. NLEB are insectivorous and the concentration of insects around water features may represent important foraging opportunities. Water sources may also be key for NLEB hydration. The proposed plan addresses potential impacts to wildlife species from livestock grazing plans and associated infrastructure. Livestock grazing plans and practices including physical structures shall 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 (FW-STD-GRAZ 01). This standard would require all grazing plans and associated physical structure be located and constructed in such a way as to maintain or improve the quality of habitats used by NLEB. The revised plan also includes direction for livestock water developments to include escape features for wildlife that inadvertently fall into the water (FW-GDL-GRAZ 08).

While developed water sources may benefit NLEB it's also important to consider the health of existing natural riparian and wetland systems. Livestock often congregate within wetland and riparian habitats during the grazing season. Over utilization of these locations has the potential to degrade the vegetative community and structure and function of the system. Proper grazing management is necessary to retain healthy riparian and wetland systems for the benefit of species such as NLEB. A collection of plan components address potential impacts from livestock grazing that could affect natural water features and other potential foraging habitat for bats, with a collection of plan components to protect streambanks, water quality, riparian areas, and woody draws (FW-GDL-GRAZ 01, 02, 04, 05), which are all important foraging habitats for bats. Implementing this direction would prevent livestock grazing from resulting in the degradation of potential northern long-eared bat foraging habitat.

Cave Management

Management direction for cave and karst resources is located in the Energy, Minerals and Geologic Areas of Interest section of the plan. Given the importance cave and geologic resources can play in providing suitable roost and wintering habitat for bat species the proposed plan includes desired conditions and other plan components to address public and other use. As stated previously humans represent a possible disease vector and disturbance source for bats. The plan stated 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 (FW-DC-EMIN 05). Plan components restrict management actions that could damage cave resources, such as logging, road construction, and other uses of heavy equipment above or near cave entrances (FW-STD-EMIN 04-07). 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. If closures of underground features are needed to provide for public safety, surveys are required for at-risk species (such as northern long-eared bats) and if such species are present, closures must accommodate their needs (FW-STD-EMIN 03). This measure would ensure that bats are neither trapped within nor blocked from entering suitable roost sites or hibernacula.

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 the revised plan. However, should northern long-eared bats be found in the future, the proposed plan includes 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 (FW-DC-RECDEV 09). New developed recreation sites should not be placed within 0.5 miles of known hibernacula or maternal roost sites (FW-GDL-WLBAT 03). This restriction is consistent with recommendations outline in the 2016 final 4(d) rule regarding placement of new recreational

developments. Avoiding the concentration of human use near hibernacula and maternal roost locations will minimize potential disturbance of these key habitats and protect them from intentional and incidental take. See the previous disease discussion for protections related to the spread of potential disease through recreational activities.

Effects from Energy and Minerals Development

The revised plan addresses 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. Plan components include a guideline to locate and design new wind energy developments to minimize impacts to bats (FW-GDL-WL 07).

Cumulative Effects

Cumulative effects under the Endangered Species Act include state, Tribal, local or private actions that are reasonably certain to occur within the action area for Northern long-eared bat. Approximately 78176 acres of state, county, city, and privately-owned lands fall within the boundaries of the Custer Gallatin National Forest in areas where NLEB may be present. This Non-federal ownership accounts for about 11% percent of all lands where NLEB may be present within the CGNF boundary. Surrounding non-federal lands typically contain lower levels of forested habitat. Given the low level of potential suitable habitat ongoing and future human activities on these lands have only limited potential to adversely affect NLEB. Since the Forest Plan is a programmatic document that that does not mandate, authorize or approve any site-specific projects or actions, it has no direct effects on NLEB, but could have indirect effects as future projects and activities are planned, approved and implemented in compliance with the revised plan. Therefore, cumulative effects may result with ongoing and future actions allowed or implemented under land management plans for non-federal lands.

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 NLEB as a species of greatest conservation need. However, Montana has developed White-Nose Syndrome Prevention and Response Guidelines through a collaborative effort of involving multiple Federal, State, and private entities. The purpose of these guidelines is to provide conservation and disease management direction to minimize the spread of WNS to bats in Montana. The goal of these guidelines is to protect all species of bats that occur in Montana by preventing or minimizing the human-assisted spread of WNS, developing approaches for early detection of WNS, and facilitating control actions if they are developed in the future. This document is intended to assist decision makers in coordinating a statewide response if WNS is detected within or near state boundaries.

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.

Community Wildfire Protection Plans (CWPP) are collaborative agreements between local governments, fire departments, and State forest management agencies in consultation with Federal land management agencies and other interested parties. CWPPs identify and prioritize areas needing hazardous fuel reduction on Federal and non-Federal lands to protect at-risk communities and essential infrastructure. CWPPs may assist State, local and private landowners by identifying areas in greatest need of fuel reduction treatment as well as recommending effective and efficient measures to reduce the chance that wildfire will ignite structures on their property (USDA FS 2004). CWPPs could encourage non-federal landowners to conduct fuel treatment projects in NLEB habitat that may temporarily or permanently alter habitat quality. All Montana and South Dakota counties located in the geographic areas with potential for NLEB presence currently have CWPPs. Approximately 15% of the two geographic areas with potential NLEB habitat are within a CWPP.

Determination of Effects

This biological assessment analyzes the potential impacts to northern long-eared bats through implementation of the programmatic Custer Gallatin National Forest revised land and resource management plan. Impacts to northern long-eared bats and their habitat have been considered in the context of factors that may influence survival and habitat use. The Forest has made the determination that implementation of the proposed Forest Plan *may affect but will not likely adversely affect* northern long-eared bat. Effects of the programmatic direction are insignificant and/or discountable due to plan components that guide potential forest actions with consideration given effects on bat species and habitat:

- 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 2015). The proposed plan components would protect and conserve of maternal roost trees and hibernacula and the surrounding habitat from physical alteration and will protect essential behavioral patterns. These represent the most important habitat components identified in the 4(d) rule. Plan components are designed to prevent both incidental and intentional taking of NLEB.
- Plan components would limit mechanical tree removal within a prescribed distance (0.25 miles) of known winter hibernacula in order to maintain vegetative conditions that may be associated with microclimates important to bats inside hibernacula (FW-GDL-WLBAT 01).
- Any tree removal within the 0.25 miles of a known hibernacula must result in direct benefits to habitat condition for bats (FW-GDL-WLBAT 01)
- Plan components would also prohibit the removal of known bat maternal roost trees during the pup season and protect potential roost habitat within 150 feet of known locations (FW-GDL-WLBAT 02).
- 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).
- Limited suitability for hibernacula habitat (no know locations to date).
- Agency personnel and other authorized users such a contractors to utilize established decontamination procedures prior to entering caves or abandoned mines known to be used as roost sites or winter hibernacula (FW-STD-WLBAT 01)

- Designed to minimize the risk of WNS transmission so that key habitats are free of disease (FW-DC-WLBAT 01)
- Concentrated human use will be placed at least one-half mile from any known hibernacula or roost site (FW-GDL-WLBAT 03)
- 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 (FW-GDL-WLBAT 01).
- Plan components would also prohibit the removal of known bat maternal roost trees during the pup season, and limit disturbance nearby (FW-GDL-WLBAT 02).
- Cave resources should provide for wildlife habitat requirements and stress-free and disease-free conditions for vulnerable cave-associated species, such as northern long-eared bats and other bat species (FW-DC-EMIN 05)

Canada lynx

Species status and ecological information

Population status and distribution

The lynx population in the Continental U.S. was listed as threatened in 2000, primarily due to a lack of adequate regulatory measures to conserve lynx habitat on federal lands at that time (USDI FWS 2000). In a recently completed 5-year review, the Fish and Wildlife Service concluded that the Canada lynx distinct population segment in the contiguous U.S. is “not in danger of extinction throughout all of its range or likely to become so in the foreseeable future... and recommend removing the Canada lynx DPS, currently listed as threatened, from the list of threatened and endangered species” (USDI FWS 2018a).

In the contiguous U.S. lynx have likely always occurred at lower densities than in Canada and Alaska, due to naturally patchier and more marginal habitat that occurs in the southern part of the species’ range, where boreal forest transitions to more temperate forest types. Lynx populations in the lower 48 U.S. are typically small and generally isolated from each other, although many are contiguous with source populations in Canada (USDI FWS 2014). In the western U.S. (excluding Alaska), lynx are most common in northwestern Montana, decreasing in abundance to the south and east (Koehler and Aubry 1994).

Habitat requirements and life history

The Canada lynx is a medium-sized forest carnivore that is strongly associated with its primary prey species, the snowshoe hare (*Lepus americanus*). Both the lynx and its primary prey are highly adapted to survive in boreal forest conditions, where winters are characterized by deep accumulations of soft, fluffy snow (Koehler and Aubry 1994). 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. Research specific to wolverines (whose habitat overlaps with lynx habitat to some degree) indicates that a pattern of reduced snowpack in wolverine habitat has been in place since at least the 1950s (McKelvey and Buotte *in* Halofsky et al. 2018b). A variety of climate models predict that the Greater Yellowstone Area (GYA) 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 (McKelvey et al. 2011, Bell et al. 2016).

Lynx use a variety of successional stages for different life cycle needs. Recent research in northwest Montana (Holbrook et al. 2017, 2019; Kosterman et al. 2018) 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 dominant tree species. These studies showed that the proportion and connectivity of mature forest structure, along with interspersions of younger, smaller diameter, regenerating forest, were of high importance for lynx. This relationship appears to be largely driven by food availability, since the younger, regenerating forest supports the highest densities of snowshoe hares, but the mature forest structure is where lynx are able to hunt hares most efficiently. These findings were based on studies conducted in northwest Montana, which supports a resident population of lynx. The GYA, including the Custer Gallatin Forest, is generally higher elevation, more open, and often more precipitous than northwest Montana, resulting in proportionately more non-forest, drier forest, and steep, rocky terrain conditions that do not typically 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 of boreal forest than found in northwest Montana (USDI FWS 2014).

Foraging habitat and reproductive denning habitat are two factors of high importance to lynx populations (USDI FWS 2000). Optimum foraging habitat for lynx is that which supports high densities of snowshoe hares. Snowshoe hares select for dense horizontal cover that provides hares with food, protection from predators, and thermal cover from extreme weather conditions (Hodges 2000, Ruediger et al. 2000). Winter is the most difficult time for lynx to find sufficient prey to survive. However, both the lynx and its primary prey are highly adapted to survive where winters are long, and characterized by deep accumulations of soft, fluffy snow (Koehler and Aubry 1994). The lynx's long legs and large, furry feet make it well-adapted to travel across deep snow in pursuit of hares, thus affording a competitive advantage for hunting in wintery conditions over more generalist predators. Accordingly, the lynx diet in winter is primarily restricted to snowshoe hares. Winter snowshoe hare habitat consists of places where young trees or shrubs grow densely, and are tall enough to protrude above average snow depth, and also where overhanging conifer boughs touch the snow surface. These conditions are most prevalent in young, advanced regeneration conifer stands as well as in older, multi-storied conifer stands. The summer diet of lynx may contain a broad range of alternate prey species in addition to snowshoe hares, such as other small mammals, birds, fish, and ungulates, including carrion (USDA 2007, Squires 2010, ILBT 2013).

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. Female lynx select areas with abundant coarse, woody debris for reproductive den sites. Snags, logs, or root wads of fallen trees provide cover that protects lynx kittens from predators and other environmental threats. Reproductive denning areas must be reasonably close to foraging habitat, so that the female lynx can hunt while leaving the kittens unattended nearby (ILBT 2013). The amount of coarse woody debris is the key component of lynx denning habitat, rather than the age of the forest stand (USDA 2007). The structural components of denning habitat may be present in younger forests affected by disturbance, and in mature and older stands where tree mortality occurs as a result of disturbance as well as the natural aging process.

Lynx may also use a variety of boreal forest types in early- to mid-succession that lack the dense horizontal cover required by snowshoe hares and the coarse, woody debris used for reproductive denning, but still provide adequate 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 low horizontal cover for hares, and other harvest areas where dead and dying trees that would contribute to lynx denning habitat are removed for salvage or sanitation purposes. Lynx will travel through these areas when moving between patches of snowshoe hare habitat, or between foraging and denning habitat, and occasionally may find alternate prey species in these habitats (Squires et al. 2010). Stands that currently have low horizontal cover and coarse woody debris have the potential to produce snowshoe hare habitat and/or denning habitat through disturbance and natural succession as young trees and shrubs fill gaps, trees die and fall to the ground, 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. 2019).

Early stand-initiation stage lynx habitat is that which 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, and even travel areas for resident lynx. 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 2007). Resident lynx tend to avoid, or travel quickly through large open areas (Squires et al. 2010). However, some authors (Ruediger et al. 2000, Vanbianchi et al. 2018) have reported that dispersing lynx (i.e. those leaving their natal area or existing home range in search of new home range) are known to travel through large areas of limited forest cover.

Critical habitat has been designated for Canada lynx (USDI FWS 2014). Critical habitat considerations for lynx are addressed as a separate topic later in this BA.

Environmental Baseline

Population status and distribution in the action area

Canada lynx may be present in the MHG, AB, BBC and Pryor Mountain Geographic Areas of the Forest. The Custer Gallatin National Forest is part of the Greater Yellowstone Area (GYA), which is geographically isolated from other areas occupied by lynx in the continental U.S., as well as from source populations in Canada. Lynx have been historically present in the GYA, but the consistency of lynx occurrence over time is unknown. It is uncertain whether the GYA historically contained a small but persistent population of lynx, or whether the area naturally supported resident lynx only periodically when habitat and prey conditions were favorable. The majority of recent and historical verified detections of lynx in the GYA are from the Bridger-Teton National Forest in Wyoming, with fewer verified reports of lynx from other parts of the GYA including Yellowstone and Grand Teton National Parks, as well as the Custer Gallatin National Forest. Few lynx have been detected in the GYA since 1997, with none detected since 2010. The current number of lynx in the GYA is unknown, but believed to be quite small, with likely fewer than ten lynx, and perhaps none (Bell et al. 2016, USDI FWS 2017).

In line with the rest of the GYA, lynx were historically present in low numbers on the Custer Gallatin National Forest, as evidenced by trapping and other records. Total documented occurrences on the Forest are rare, with the most recent in 2009, which involved a single female lynx (verified by DNA testing) that had been tracked in the Mill Creek Drainage of the AB Geographic Area for six consecutive years. There was no evidence of any other resident lynx on the Forest during that timeframe, nor has there been any documented occurrences since (GNF monitoring report 2011). However, in addition to this lone resident female, Ivan (2012) reported that between 2004 and 2007, a number of GPS-collared lynx that were relocated to Colorado from Canada dispersed northward. Of these, five male and two female lynx showed evidence of travel within or near the Custer Gallatin National Forest, including possible locations within all montane Geographic Areas on the Forest. Accuracy and precision of collar locations was variable, making lynx presence on NFS lands difficult to verify, but it is likely at least some of these dispersing lynx did spend time on the Custer Gallatin, given the habitat quality of surrounding areas. These lynx were present within or near the Forest for brief periods of time, indicating transient use, since they did not linger, or attempt to establish a home range within the Custer Gallatin Forest boundary.

Low numbers of verified lynx records on the Custer Gallatin National Forest may reflect lynx habitat that is naturally fragmented by intervening open or drier habitats, resulting in patchy distribution, which may provide marginal conditions for long-term residential lynx occupation due to limited capability to support snowshoe hares. Track and pellet surveys combined with incidental observations indicate that existing conditions on the Custer Gallatin support low densities of snowshoe hares (Zimmer et al. 2008), compared to other areas where lynx occupancy is more consistent.

Habitat conditions in the action area

Boreal forest conditions that provide lynx habitat are found in the montane ecosystem on the Custer Gallatin National Forest, which includes the following Geographic Areas (GAs): Madison, Henrys Lake and Gallatin Mountains (MHG); Absaroka Beartooth (AB); Bridger, Bangtail and Crazy Mountains (BBC); and the Pryor Mountains (PM). Therefore, the montane ecosystem was used as the analysis area for lynx and lynx habitat. Lynx analysis units (LAUs) provide a fundamental scale at which to evaluate and monitor the effects of management actions on lynx habitat. LAUs do not depict actual lynx home ranges, but their size and configuration generally approximates the scale of area used by a resident lynx, with habitat components necessary for year-round use by lynx. The montane ecosystem geographic areas are further delineated into LAUs based on presence of contiguous lynx habitat. However, structural conditions within LAUs can change fairly quickly at the LAU scale within the expected life of the plan, due to natural processes or management actions. For this reason, and because the forest plan neither mandates nor authorizes any site-specific actions, effects analyses for programmatic direction cannot be attributed to specific LAUs with any degree of certainty. Therefore, the environmental baseline and effects analyses for lynx are generally presented at the GA or larger scale. Estimated current habitat conditions for individual LAUs on the Forest can be found in appendix 3 to this BA.

The Recovery Outline for Canada Lynx (USDI FWS 2005) categorizes lynx habitat in the continental U.S. as “core”, “secondary,” or “peripheral” based on historic and current occupation by lynx. Core areas have verified records of lynx presence over time and recent evidence of reproduction. Areas with historic records of lynx presence but no documentation of reproduction are identified as secondary areas, and peripheral areas are those with only sporadic detections of lynx (Ibid). 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 (ILBT 2013). An important distinction for applying plan components from the Northern Rockies Lynx Management Direction (NRLMD; USDA 2007) is whether lynx habitat is currently designated as occupied per the 2006 Amended Conservation Agreement and NRLMD (USDA FS and USDI FWS 2006, USDA 2007). According to the Amended Conservation Agreement and NRLMD, the AB and MHG GAs are currently designated occupied, even though lynx may not be detected in these areas for periods of time, and no lynx have been documented on the Forest for at least ten years. According to the Amended Conservation Agreement and NRLMD, the BBC and PM GAs contain potential lynx habitat, but are currently designated unoccupied. Although unoccupied areas may have occasional transient use by lynx traveling between more suitable areas, such use is believed to be rare. Henceforth, the terms “occupied” and “unoccupied” used in reference to lynx habitat indicate areas designated as such in the 2006 Amended Conservation Agreement and NRLMD (Ibid).

Within the montane ecosystem of the Forest (where lynx may be present), roughly 56 percent of the area is core occupied; 33 percent is secondary occupied, 8 percent is secondary unoccupied, and 3 percent is peripheral unoccupied. The montane ecosystem of the Custer Gallatin is located in the northwest portion of the GYA, which is a strategic location for lynx movement between the GYA and other areas occupied by lynx, such as northwest Montana and Colorado. Lynx are not known to have been historically present in the pine savanna ecosystem on the Forest (Ashland and Sioux GAs). Since it contains only dry forest habitat types (*Pinus ponderosa*), the pine savanna ecosystem lacks suitable habitat for lynx, and will not be addressed further. Table 3 shows lynx habitat by category.

Table 3. Lynx Habitat Categories by Geographic Area

Geographic Area	Occupied	Type	Critical Habitat
Absaroka Beartooth	Yes	Core	Yes
Madison Henrys Lake Gallatin	Yes	Core, Secondary	Yes
Bridger Bangtail Crazy	No	Secondary	No
Pryor Mountains	No	Peripheral	No
Ashland	No	Not Applicable	No
Sioux	No	Not Applicable	No

Core habitat for lynx on the Custer Gallatin is located in the AB GA, of which roughly 68 percent is within designated wilderness (Absaroka-Beartooth). Timber harvest is prohibited and fire suppression has been negligible in the wilderness area. An additional 20 percent of this geographic area is within recommended wilderness, and/or inventoried roadless areas, which have fewer restrictions than wilderness, yet limitations are placed on certain management actions. As a result, natural disturbance and successional processes have largely shaped lynx habitat conditions in core areas. Most of the secondary lynx area considered occupied is in the MHG GA, which is roughly 17 percent designated wilderness (Lee Metcalf), with an additional 49 percent in Wilderness Study Area, recommended wilderness and/or inventoried roadless area. These designated areas all have land use restrictions that provide some level of restrictions on management actions in lynx habitat. Secondary unoccupied lynx habitat is found in the BBC GA. While there is no designated wilderness in this GA, approximately 62 percent of the GA is in inventoried roadless area, resulting in some management restrictions, but ultimately open to a wider variety of management actions than occupied lynx areas. Finally, only peripheral lynx habitat is found in the Pryor Mountains GA, where only transient use by lynx has been

recorded in recent decades, but also where there is no designated wilderness, and only 14 percent of the GA is in recommended wilderness and/or inventoried roadless area. These land use designations cover both lynx habitat (boreal forest) and non-lynx habitat, limiting management in lynx foraging and denning habitat as well as maintaining habitat connectivity in designated areas.

On the Custer Gallatin, lynx habitat is typically found in the subalpine and upper montane forest zones. Lynx habitat is dominated by subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmanni*), with increasing presence of lodgepole pine (*Pinus contorta*) and pockets of aspen (*Populus tremuloides*) appearing toward the transition with upper montane forest types (Ruediger et al. 2000). While spruce and subalpine fir are typically the indicated climax tree species in lynx habitat on the Forest, lodgepole pine and mixed conifer species (spruce, fir and pine) often dominate cover types in lynx habitat. In cool, moist conditions, Douglas-fir (*Pseudotsuga menziesii*) may be a minor component of lynx habitat in the upper montane forest zone, often in mixed forest that also contains subalpine fir, spruce, lodgepole pine and/or aspen. The warmer, drier forests dominated by Douglas-fir or limber pine (*Pinus flexilis*) habitat types do not support snowshoe hares or lynx (ILBT 2013). Likewise, pure whitebark pine (*Pinus albicaulus*) habitat types found at higher elevations generally do not provide 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 good lynx habitat but may be crossed by lynx moving between patches of suitable habitat.

Most of the research on lynx in Montana has occurred west of the Continental Divide, where habitats are more contiguous (less fragmented), adjacent to source populations in Canada, and generally more favorable for snowshoe hares and lynx with larger, more connected patches of boreal forest (ILBT 2013). As a result, lynx habitat use patterns east of the continental divide, including the GYA (and Custer Gallatin Forest), are not well understood. Lynx habitat mapping recommendations were outlined in the Lynx Conservation Assessment and Strategy (LCAS) (Ruediger et al. 2000), and adopted as direction in the NRLMD (USDA 2007). This direction was later clarified by a Forest Service Regional Office memo (Marten 2016). In 2010 National Forests east of the continental divide in the Northern Region (Helena, Lewis & Clark, Custer and Gallatin) began collaborating on a uniform method to map lynx habitat categories consistent with the LCAS and NRLMD (Ruediger et al. 2000, USDA 2007). This effort, referred to as the “East Side Assessment” (Canfield 2016), was intended to develop reliable, consistent lynx habitat mapping and modeling protocols that could be used for mid- to large-scale assessments such as forest planning. Due to a lack of local data on lynx habitat use, lynx habitat characteristics used in the East Side Assessment were derived from research on lynx in other areas, including, but not limited to, northwest Montana. The methods developed in the East Side Assessment are consistent with direction presented by the Regional Forester (Marten 2016).

Lynx Habitat Mapping

Using methods established in the East Side Assessment, a geographic information system was used to estimate amounts of lynx habitat within the Custer Gallatin National Forest boundary. Lynx habitat areas were predicted by selecting potential vegetation types deemed capable of producing the boreal to subalpine forest conditions most frequently used by lynx and snowshoe hares. Potential vegetation type information was obtained from a Regional (Northern Region, U. S. Forest Service) database, (R1 Broad PVT data layer), which classifies broad areas based upon assemblages of potential natural vegetation (or habitat types) with similar biophysical characteristics (e.g. slope, aspect, elevation), disturbance regimes, species composition, structural characteristics, productivity and successional

trends into mature forests (Milburn et al. 2015). In other words, potential vegetation types provide a very coarse filter system for predicting potential lynx habitat based on a broad-scale estimate of indicated climax plant species. The cool, moist forest PVT accounts for the majority of mapped lynx habitat, with some inclusions of cold forest types. Riparian and shrubland types account for secondary lynx habitat where they are associated with the cool, moist or cold forest types. Table 4 shows the proportion of broad PVT types by GA for the portion of the Forest with mapped lynx habitat.

Table 4. Distribution by percentage of potential vegetation types in GAs with mapped lynx habitat

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

¹Potential vegetation types most likely to produce lynx habitat

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. Various forest succession stages may be used by lynx and snowshoe hares for different purposes as described previously. Therefore, lynx habitat mapping was further refined through an evaluation of existing forest cover types and structural conditions based on dominant tree species, average tree size, canopy cover and time since last disturbance (Canfield 2016). Existing cover type information was extracted from the Northern Region vegetation database (R1 VMap), which represents current vegetative conditions based on remotely sensed reflections of the earth’s surface (satellite imagery). VMap classifications are also informed by aerial photography and ground-based, field-verified sampling of vegetation communities (Barber et al. 2011).

As with all models, there is uncertainty in the lynx habitat mapping process used to estimate lynx habitat potential on the Custer Gallatin National Forest, particularly given the lack of empirical data for lynx habitat use patterns in this area, but also considering the limits of available data. R1 Broad PVT contains a coarse grouping of forested habitat types found in Montana (Pfister et al. 1977), with reasonable accuracy at a very broad scale, but for which accuracy declines as scale decreases. R1 VMap is the primary vegetation data set used to estimate current amounts and distribution of various lynx habitat structural stages. VMap is useful for predicting many aspects of potential lynx habitat. For example, it classifies vegetation by lifeform, such as conifer (tree), shrub, or herbaceous (grass/forb), and can distinguish between vegetation and non-organic cover like rock. It also contains information about dominant tree species, size class and canopy cover, which are good indicators of potential lynx habitat. However, understory structure is important for lynx, as this component is what provides, or lacks, the dense horizontal cover selected by snowshoe hares. 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 closer to the ground. For this analysis, time since last major disturbance, tree size, and canopy cover, combined with local knowledge, were assumed to

provide reasonably accurate representations of forest structure, including the presence of dense horizontal cover for hares and coarse woody debris for lynx reproductive dens sites, in the forest understory.

Using methods established in the East Side Assessment for lynx and customized for the Custer Gallatin National Forest (Canfield 2016), potential lynx habitat was mapped for the montane ecosystem geographic areas. Results of this process reflect a point in time, and are subject to change over time, since lynx habitat components may change as a result of natural succession or disturbance. For example, an area currently in early stand-initiation stage that is 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 and/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. Given this large landscape and the programmatic nature of the forest plan, remotely sensed data informed by field-verified information and local knowledge, provide the best available information upon which to base our modeled lynx habitat. Refinement of broad scale lynx habitat mapping is expected to occur as better data or technology become available (Ruediger et al. 2000, USDA 2007, USDI FWS 2007 and ILBT 2013). Site-specific validation of lynx habitat types and structural stages could greatly improve lynx habitat mapping reliability for future projects implemented under the plan, as well as provide a basis for updating forest wide lynx habitat mapping over time.

Early stand initiation stage lynx habitat reflects recently disturbed areas in which all or the vast majority of trees have been removed by fire, harvest, or other disturbance, and new trees are not yet tall enough to protrude above the average snow depth in winter. Early stand initiation stage lynx habitat may provide summer foraging opportunities for snowshoe hares, but do not provide winter snowshoe hare habitat. This category is estimated based upon the potential vegetation (R1 Broad PVT) predicted to be capable of producing boreal forest conditions, combined with recent imagery (R1 VMap) indicating a lack of forest cover. Fire and timber harvest databases (MTBS and FACTS respectively) indicate that these areas have been recently altered by fire or mechanical harvest. 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 high severity fire, some areas predicted (by R1 Broad PVT) to be capable of producing boreal forest conditions, but currently shown (by R1 VMap) as having no trees present, are more difficult to assess. These typically involve areas within a fire perimeter, but within a low to moderate fire severity class, where some evidence of tree survival or regeneration is expected, but not indicated by VMap classification. 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 near future. To err on the conservative side, the Custer Gallatin lynx habitat model assumes these types are potential lynx habitat that is currently in an early stand initiation stage. This assumption may result in an overestimate of this particular lynx habitat component.

Winter snowshoe hare habitat most commonly develops in the stand initiation stage several years after a disturbance when trees are tall enough to protrude above the snow, or during understory re-initiation

in mature and late-succession forest structural stages. 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” and “other”; that is, it is quite possible that stands modeled as other habitat may actually provide multi-storied snowshoe hare habitat and vice-versa.

“Other” lynx habitats (as displayed in table 6 below) include young to mature forest 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 live trees standing, but with low levels of horizontal cover near the ground (or snow surface). Structural conditions within these types of lynx habitat are modeled based on tree species dominance type, size class, and canopy cover. Identifying these types is also susceptible to vulnerabilities of the modeling process described previously; however, there is reasonable consensus among local foresters and ecologists that these types of stands generally do not have well-developed understories that provide adequate food and cover for snowshoe hares (Canfield 2016), but they may contain coarse, woody debris that could contribute to lynx denning habitat.

Lynx reproductive denning habitat is characterized by large amounts of coarse woody debris (e.g. large, down logs and root wads from fallen trees), which can occur over a wide range of successional stages in forest habitat. Quality of denning habitat is influenced by proximity to foraging habitat, meaning the best quality denning habitat is where coarse woody debris is abundant within or adjacent to areas that provide habitat for snowshoe hares. The presence of coarse woody debris can be difficult to detect under a live forest canopy using remotely sensed imagery; however, due to recent large-scale ecological 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 is abundant and well distributed in lynx habitat, with equally abundant dead-standing trees available to contribute to coarse woody debris over time. Due to potential occurrence of coarse woody debris within a wide range of forest successional stages, lynx reproductive denning habitat is not modeled as a separate habitat component, but rather is assumed to be readily available and well distributed throughout lynx habitat on the Custer Gallatin National Forest. Lynx denning habitat is addressed separately for designated critical habitat later in this BA.

Finally, not all habitat types within the montane geographic areas of the Forest are considered (i.e. modeled or mapped as) potential lynx habitat. Warmer, drier forested types, as well as non-forest vegetation types (e.g. grass, forb, shrub) and non-vegetation types (e.g. rock, water), do not provide boreal forest conditions selected by lynx and snowshoe hares. These habitat types are often interspersed with, or surround lynx habitat on the Forest, and account for considerable proportions of the montane ecosystem in which lynx habitat occurs on the Custer Gallatin Forest. Such types are referred to as “non-habitat” for lynx in this analysis.

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 terms “lynx habitat” or “potential lynx habitat” only refer to

these types. The total amount of lynx habitat relative to non-habitat remains relatively constant over time, but the various structural 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 structural stage lynx habitat was quite low, at about 3 percent of the total lynx habitat across the entire montane ecosystem, and ranging from 1 percent in the MHG and BBC GAs to 6 percent in the AB GA. The low percentage of early stand initiation structural stage is generally reflective of most individual lynx analysis units as well. Twenty-five lynx analysis units have been delineated for the Custer Gallatin National Forest, four of which are designated unoccupied. A summary table showing estimates of current structural stages for all LAUs is presented in appendix 3. LAUs are described briefly here to provide context for distribution of lynx habitat in lower quality condition due to recent disturbance.

All LAUs designated unoccupied currently range between one and three percent in the early stand initiation structural stage for lynx habitat. Of the 21 LAUs that are designated occupied, 17 currently range from less than one percent up to six percent of the lynx habitat currently in the early stand initiation structural stage. These LAUs reflect conditions at the larger, Geographic Area scale. Four LAUs in occupied lynx habitat are currently estimated to contain between 7 and 26 percent early stand initiation structural stage lynx habitat. Of these, the lowest at 7 percent was affected by a large scale wildfire in 2012 and the estimate for early stand initiation structural stage is likely reasonably accurate. Another LAU currently at 8 percent early stand initiation stage for all ownerships is only at 3 percent early stand initiation when considering just NFS lands. Examination of the other land ownership in this LAU shows that over 70 percent of the habitat currently categorized as early stand initiation stage, is flagged for further verification. In other words, most of the ESI stage on private land in this LAU is in areas affected by low to moderate severity fire at some time in the recent past (0 to 40 years), but no live or dead tree legacy or regeneration is evident, although it would be expected under conditions of low to moderate burn severity. As mentioned previously, it is quite possible the amount of early stand initiation stage lynx habitat may be overestimated due to this scenario. The two LAUs with the highest estimated proportions of ESI at 19 and 26 percent are subject to the same potential classification error, with 95 and 99 percent respectively, of the ESI classification in these two LAUs being flagged as in need of further verification. This type of verification requires either high-resolution imagery or site-specific ground confirmation, to determine whether the areas currently classified as early stand initiation stage, are really potential lynx habitat at all, or are misclassified for reasons described earlier.

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 2007). Recent, large, stand-replacing fires in lynx habitat on the Custer Gallatin occurred in 2012, with the Millie Fire in the MHG GA and the Pine Creek Fire in the AB GA. 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 wild fire of appreciable scale in lynx habitat was the 2018 Bacon Rind Fire, which burned roughly 3,650 acres on the Custer Gallatin near Yellowstone National Park, in the MHG GA. Preliminary modeling estimates that of the acres burned on the Forest, the Bacon Rind fire affected roughly 1,200 acres of lynx habitat with low, moderate or high severity fire. This relatively small acreage does not appreciably change the amount of early stand initiation lynx habitat in the MHG GA, but changes the amount of early stand

initiation stage in the Upper Gallatin LAU from less than 1% to 3% (see appendix 3 for individual LAU results).

Large-scale disturbances produce early stand-initiation habitats that are temporarily low quality habitat for snowshoe hares and lynx, in that trees are not yet tall enough to protrude above the snow to provide winter habitat for snowshoe hares, and because trees may not be dense enough to provide even summer foraging habitat for snowshoe hares. However, the affected areas often regenerate to produce a stand initiation structural stage, with high quality snowshoe hare habitat as trees become tall and dense enough to protrude above the snow and provide year-round food and cover for hares. On the Custer Gallatin National Forest, it takes an average of about 16 years after a disturbance to produce tree height and density 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, the younger stand-initiation stage snowshoe hare habitat component accounts for approximately 7 percent of lynx habitat, while the multi-story structural stage is estimated to occur in approximately 40 percent of lynx habitat. The multi-story structural stage is modeled based upon the best available information using remotely sensed data for a large area. However, horizontal cover is difficult to detect or model using remotely sensed vegetation data, so while the multi-storied structural stage is the most likely areas to support snowshoe hares in mature lynx habitat, the model cannot accurately predict how much of the multi-story structural stage actually contains sufficient horizontal cover to support snowshoe hare use. Combining the stand-initiation stage with the multi-story structural stage indicates that nearly half (47 percent) of the lynx habitat on the Forest is potential snowshoe hare habitat as of the time of this analysis. However, the fact that snowshoe hares occur at lower densities on the Custer Gallatin than in more productive environments elsewhere suggests that the amount of potential snowshoe hare habitat may be overestimated, or it may be that the habitat is patchily distributed over such a large area that snowshoe hares cannot make efficient use of it.

Looking at individual geographic areas, the MHG GA has the most acres and greatest proportion of potential snowshoe hare habitat (stand initiation stage and multi-storied combined). The Pryor Mountains GA 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 BBC GA has average proportion of snowshoe hare habitat, but relatively low acres compared to the larger geographic areas, while the AB GA has the lowest proportion of potential snowshoe hare habitat but second highest total acreage. The AB is by far the largest GA 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. Large areas burned in the AB GA in the early 2000s are expected to begin to produce stand-initiation stage snowshoe hare habitat in the near future. As with early stand initiation structural stage, individual LAUs are generally consistent with the forest plan Geographic Areas in which they occur for the proportion of stand initiation and multi-storied mature structural stages that provide winter snowshoe hare habitat.

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 mapped lynx habitat on the Forest was classified as “other” types that do not provide high-quality snowshoe hare habitat, but may provide denning habitat and cover suitable for lynx to rest in or travel through. Individual geographic areas range from the highest proportion of this type in the AB GA (at 58 percent of total lynx habitat), and the lowest in the MHG GA (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 wider 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 2007), 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 dominated 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. Not only do subalpine fir and spruce dominate forest cover types on the Flathead NF, but they are the two most common tree species, occurring on all but the driest sites on the Flathead NF (USDA 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 (Table 5). It is noteworthy that Holbrook et al. (2017) looked specifically 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.). What is notable is that the Custer Gallatin appears to have a lower inherent capacity to produce forest cover types shown to be selected by resident lynx, and could therefore also have a lower natural capacity to support lynx, regardless of management direction.

Table 5. Existing and desired conditions for coniferous forest dominance types (percentage of forest area in the dominance type). Desired condition applies to lands with a forested potential vegetation, at the forestwide scale.

Dominant Species ¹	Desired Range ² (% of Area)	Existing Condition ³ (% of Area)
Douglas fir	15% - 30%	23%
Ponderosa pine	10% - 15%	9%
Lodgepole pine	15% - 30%	24%
Engelmann spruce/Subalpine fir	10% - 20%	12%
Whitebark pine	15% - 20%	14%

1. Dominance reflects the most common tree species in a stand
2. Desired condition is informed by a natural range of variability analysis using SIMPPLLE, a spatially explicit, landscape level, dynamic simulation model (appendix D)
3. Existing condition is from the “Dom40” attribute of Northern Region Vegetation Map data based on 2015 imagery and does not include recently disturbed forest. Existing condition values do not sum to 100% because approximately 15% of the forested vegetation is in an early seral condition and not associated with dominance by any particular species or is dominated by minor species such as aspen

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 CGNF. 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 montane GAs 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 AB and MHG GAs. As a result, there is abundant 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 (see BA appendix 3).

Kosterman and others (2018) reported that large amounts of highly connected mature forest are required by reproductive female lynx in northwest Montana. As previously discussed, the Greater Yellowstone Area (of which the Custer Gallatin is a part) has more patchy overall conditions with naturally lower connectivity than found in northwest Montana (USDI FWS 2014). It should be noted that Kosterman and colleagues (2018) looked at 50 percent annual home ranges or “core areas” for reproductive 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, about 60 percent of the cool, moist forest types with average tree size greater than 5 inches diameter, have a contiguous patch size of greater than 100 acres, and nearly 39 percent of those same forest types in patch sizes over 1,000 acres (table 11). Large patch size suggests a pattern of reasonably good connectivity for mature forest lynx habitat on the Custer Gallatin at the time of this analysis. However, interspersions of drier forest types, open meadows, rock and sparse vegetation types frequently occur between large patches of lynx habitat on the Custer Gallatin, which can affect connectivity of habitat for lynx. Further, patch-size 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 area 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 through such areas, but are not expected to reside in these habitats. The AB GA has the largest acreage of non-lynx habitat due primarily to the considerable amount of area above timberline. The Pryor Mountains GA has the lowest acreage of non-lynx habitat, but the highest proportion given its relatively small size. Table 6 represents current estimates of lynx habitat by geographic area within the Custer Gallatin National Forest.

Table 6. Acres and proportion of mapped lynx habitat on the Custer Gallatin National Forest – NFS only

Lynx Habitat	Early Initiation ¹	Stand Initiation ¹	Other ¹	Multi Story ¹	Total Lynx Hab ²	Non Habitat ²	Total ³
Occupied							
AB (Core)	22,567 6%	33,656 8%	232,461 58%	110,714 28%	399,398 29%	959,143 71%	1,358,541
MHG (Secondary)	5,540 1%	22,212 5%	190,379 43%	229,077 51%	447,208 55%	359,408 45%	806,616
Total Occupied	28,107 3%	55,868 7%	422,840 50%	339,791 40%	846,606 39%	1,318,551 61%	2,165,157 89%
Unoccupied							
BBC (Secondary)	1,537 1%	8,129 7%	61,526 50%	52,185 42%	123,377 60%	81,770 40%	205,148
Pryors (Peripheral)	403 3%	179 1%	6,216 45%	6,909 51%	13,707 18%	61,360 82%	75,067
Total Unoccupied	1,940 1%	8,308 6%	67,742 50%	59,094 43%	137,084 49%	143,130 51%	280,215 11%
Occupied and Unoccupied Combined							
Total Forestwide	30,047 3%	64,176 7%	490,582 50%	398,885 40%	983,690 40%	1,461,681 60%	2,445,372

¹Percent represents proportion of mapped lynx habitat

²Percent represents proportion of total area (lynx habitat + non habitat)

³Percent represents proportion of GAs where lynx may be present (occupied + unoccupied)

Factors affecting Canada lynx

The revised Lynx Conservation Assessment and Strategy (ILBT 2013) identifies anthropogenic influences on lynx and lynx habitat, described in two tiers. First tier anthropogenic influences can directly affect both snowshoe hare and lynx populations. First tier factors include vegetation management, wildland fire management, habitat fragmentation, and climate change. Second tier anthropogenic influences include those that research and management experience has shown to be less likely to have substantial effects to lynx and their habitat. Second tier factors include incidental trapping, recreation, mineral and energy exploration and development, illegal shooting, backcountry roads and trails, and domestic livestock grazing (Ibid).

Effects of the proposed action on factors affecting Canada lynx in the action area

The revised plan, including components adopted from the NRLMD, provides programmatic direction, and does not propose, approve, authorize or mandate projects or other site-specific management actions. As a result, the proposed action would have no direct effects on lynx or their habitat. Rather, the plan could result in indirect effects as future projects are implemented in conjunction with plan direction, some of which could affect lynx and their habitats.

The revised plan contains 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 (FW-DC-WL 02). Specific to lynx, the revised plan includes a desired condition 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 (FW-DC-WLLX 01) and a requirement to follow the Northern Rockies Lynx Management Direction (FW-STD-WLLX 01). In addition to a desired condition specific to lynx, the revised plan includes complimentary coarse filter components in the form of desired conditions for wildlife in general that vegetation conditions are within the natural range of variation to provide habitat for assorted life cycle needs of a diverse suite of wildlife species (FW-DC-WL 03). 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.

Coarse filter plan components for wildlife are supported by measurable plan components for terrestrial vegetation, fire and fuels management, which provide substantial detail regarding the desired extent, frequency, and severity of ecosystem processes (FW-DC-FIRE 01, FW-OBJ-FIRE 02), and in turn, drive ecological structure, composition and function described in vegetation plan components (FW-DC-VEGF 01, 03, 06 and 08). Compared to existing plans, coarse filter plan components for the revised plan provide a clearer trajectory for desired vegetation conditions, which would promote habitat conditions and biodiversity important to lynx, and are consistent with and complimentary to NRLMD Objectives for lynx habitat conditions over time (Objective VEG 01, VEG 03), which call for management actions to approximate natural processes and fire use that restores ecological processes.

Substantial research from northwest Montana where lynx populations occur providing opportunities for study, indicate that mature, spruce-fir forest types are used by lynx more than any other habitat conditions, that these habitat types typically represent at least 50 percent of the lynx habitat within a female lynx home range (Holbrook et al. 2017), and that connectivity of mature spruce-fir forest types is an important factor in core use areas for reproductive female lynx (Kosterman et al. 2018). Lynx occurrence on the CGNF is rare, and consequently, no such parameters are available for lynx habitat use on the Forest, nor have there been any documented home ranges or core use areas for reproductive female lynx on the CGNF. However, coarse filter plan components for forested habitats address similar habitat elements, although at a broader scale, while plan components adopted from Northern Rockies Lynx Management Direction address these factors at the LAU scale, which is intended to represent a theoretical female lynx home range (Ruediger et al. 2000; USDA 2007).

The revised plan includes a desired condition that the amount and distribution of forest cover types supports the natural diversity of seral stages, habitats and species diversity across the landscape and allows for appropriate recruitment and responses following disturbances (FW-DC-VEGF 01). Plan direction adopted from the NRLMD also seeks to provide a mosaic of habitat conditions through time that support dense horizontal cover and associated high densities of snowshoe hares (Objective VEG O2). The plan then identifies the desired range of coniferous forest dominance types across the landscape, based on estimates of the natural (historic) range of variation of forested vegetation on the CGNF. Engelmann spruce and subalpine fir dominated coniferous forest types have historically represented 10 – 20 percent of the forested habitats on the CGNF, and future management actions would be designed to maintain spruce-fir cover types within this range. Lodgepole pine and Douglas fir are more prevalent on the CGNF landscape, and often occur in mixed species forest cover types along with spruce and subalpine fir in potential lynx habitats. Under the revised plan, lodgepole pine and Douglas fir-dominance types would be managed within the desired range of 15 -30 percent (each) for forested habitats across the CGNF. Collectively, these species could be expected to dominate 40 – 80 percent of the forested habitats on the CGNF over the life of the plan.

Cool, moist potential vegetation types typically produce the boreal forest conditions selected by lynx and snowshoe hares. The revised plan contains desired conditions for tree size classes within these broad potential vegetation types (FW-DC-VEGF 03). Holbrook and others (2018) defined mature forest cover selected by lynx as stands at least 40 to 50 years old (post-disturbance). Tree size classes identified in revised plan desired conditions for forested vegetation include: seedling/sapling (<5" DBH), small tree (5-9.9" DBH), medium tree (10-14.9" DBH) and large tree (15"+ DBH). See table 7 for desired tree size class ranges. It can easily take trees in cool moist forest types 40 to 50 years or more to grow larger than 5 inches in diameter, so using the age class provided by Holbrook and associates (ibid) for mature forest, the small, medium and large tree size classes could all provide the mature forest structure preferred by lynx. In the cool, moist forest types that produce potential lynx habitat, these size classes combined would be managed under the revised plan to represent approximately 65 to 95 percent of the cool, moist forest types. Therefore, at the broad scale, coarse filter plan components for forested habitats would maintain adequate amounts of forest habitats within a size class that meets the definition of mature forest for lynx in northwest Montana (ibid). However, it is important to note that forest conditions in the GYA are somewhat different from those studied for lynx in northwestern Montana (see Environmental Baseline discussion).

Table 7. Existing and desired conditions for tree size classes within Northern Region Broad Potential Vegetation Types

Northern Region Broad Potential Vegetation Type ¹	Size Class ²	Desired Range ³ (% of Area)	Existing ⁴ (% of Area)
Cold	Seedling and Sapling (<5" DBH)	5% - 25%	8%
	Small Tree (5–9.9" DBH)	5% - 25%	36%
	Medium Tree (10–14.9" DBH)	50% - 75%	55%
	Large Tree (15" + DBH)	5% - 20%	1%
Cool Moist	Seedling and Sapling (<5" DBH)	5% - 35%	15%
	Small Tree (5–9.9" DBH)	5% - 30%	22%
	Medium Tree (10–14.9" DBH)	35% - 60%	60%
	Large Tree (15" + DBH)	10% - 25%	3%
Warm Dry-montane	Seedling and Sapling (<5" DBH)	10% - 40%	23%
	Small Tree (5–9.9" DBH)	5% - 15%	24%
	Medium Tree (10–14.9" DBH)	20% - 35%	50%
	Large Tree (15" + DBH)	30% - 60%	3%
Warm Dry-Pine Savanna	Seedling and Sapling (<5" DBH)	5% - 35%	38%
	Small Tree (5–9.9" DBH)	1% - 25%	6%
	Medium Tree (10–14.9" DBH)	1% - 25%	48%
	Large Tree (15" + DBH)	55% - 95%	8%

1. Northern Region Broad Potential Vegetation Type is a coarse grouping of Northern Region Habitat Type Groups that is applicable for broad-scale analysis and monitoring
2. Size class is the basal area weighted average diameter class of live trees, shown as ranges of diameter at breast height, or 4.5 feet above ground level. A stand within a particular size class may contain trees of multiple diameters, smaller or larger than the average class range
3. Desired condition is informed by a natural range of variability analysis using SIMPPLE, a spatially explicit, landscape level, dynamic simulation model
4. Existing condition is forestwide. Data Source: Northern Region Vegetation Map data based on 2015 imagery

In addition to desired conditions for forest size classes, the revised plan includes desired conditions for forest density (as measured by canopy cover; FW-DC-VEGF 04), which would maintain forest canopy cover of at least 40 percent in the majority (65 to 90 percent) of the cool, moist forest types selected by lynx. See Table 8 for density class ranges by PVT. On the Custer Gallatin Forest, cool moist forest types with canopy cover of at least 40 percent are most likely to contain the high horizontal cover required by snowshoe hares, and thus targeted as foraging habitat by lynx (Canfield 2016).

Table 8. Existing and desired conditions for density classes within Northern Region Broad Vegetation Types.

Northern Region Broad Potential Vegetation Type ¹	Density Class ²	Desired Range ³ (% of Area)	Existing ⁴ (% of Area)
Cold	Low (<40% canopy cover)	20% - 65%	26%
	Medium (40–60% canopy cover)	20% - 55%	22%
	High (>60% canopy cover)	15% - 30%	52%
Cool Moist	Low (<40% canopy cover)	10% - 35%	22%
	Medium (40–60% canopy cover)	25% - 45%	18%
	High (>60% canopy cover)	30% - 65%	60%
Warm Dry - Montane	Low (<40% canopy cover)	35% - 65%	36%
	Medium (40–60% canopy cover)	30% - 50%	19%
	High (>60% canopy cover)	5% - 20%	45%
Warm Dry - Pine Savanna	Low (<40% canopy cover)	60% - 95%	76%
	Medium (40–60% canopy cover)	5% - 20%	22%
	High (>60% canopy cover)	5% - 25%	2%

1. Northern Region Broad Potential Vegetation Type is a coarse grouping of Northern Region Habitat Type Groups that is applicable for broad-scale analysis and monitoring
2. Density classes are defined by average canopy cover. Canopy cover refers to the proportion of the forest floor covered by the vertical projection of tree crowns
3. Desired condition is informed by a natural range of variability analysis using SIMPPLE, a spatially explicit, landscape level, dynamic simulation model (appendix D)
4. Existing condition is forestwide. Data Source: Northern Region Vegetation Map data based on 2015 imagery

The revised plan includes desired conditions for large (15”+ DBH), live trees (FW-DC-VEGF 07) to be present in at least 30% of the cool, moist forest habitat, and also states a desire that the amount of old growth forest is maintained or increased relative to current conditions (FW-DC-VEGF 09). Presence of large trees and old growth structure are common elements in multi-storied mature spruce-fir forest on the Custer Gallatin. Guidelines are included (FW-GDL-VEGF 01, 02, 05) that specify how future projects should be implemented to achieve these desired conditions. At the project level, direction adopted from the NRLMD to focus management in areas that have potential to improve winter snowshoe hare habitat in both stand initiation stage and multistory mature forest (Objective VEG O4, Guideline VEG G1) would help inform design criteria for projects consistent with coarse filter plan components for forest structural stage. Table 9 and Table 10 below show desired conditions for large live tree structure and old growth.

Table 9. Existing and desired conditions for large live tree structure.

Northern Region Broad Potential Vegetation Type ²	Desired Range ³ (% of area)	Existing ⁴ (% of area)
Cold	45%–80%	26% (21%–30%)
Cool Moist	30%–60%	33% (27%–40%)
Warm Dry-montane	45%–80%	31% (24%–39%)
Warm Dry-Pine Savanna	55%–95%	13% (8%–18%)

1. Large tree structure refers specifically to stands with 5 live trees per acre greater than 15 inches in the warm dry broad potential vegetation type, 10 live trees per acre greater than 15 inches in the cool moist broad potential vegetation type, and 8 live trees per acre greater than 15 inches in the cold broad potential vegetation type.
2. Northern Region Broad Potential Vegetation Type is a coarse grouping of Northern Region Habitat Type Groups that is applicable for broad-scale analysis and monitoring.
3. Desired condition is informed by a natural range of variability analysis using SIMPPLE, a spatially explicit, landscape level, dynamic simulation model (appendix D).

4. Existing condition (with 90% confidence limit) comes from the Northern Region Summary Database v. 1.9.12.

Table 10. Forestwide desired and existing condition of old growth

Northern Region Broad Potential Vegetation Types ¹	Existing Condition (90% CI) ²	Desired conditions
Forestwide	17% (15% - 20%)	Old growth is distributed widely across the forest, and levels vary depending on available compositions and structures, disturbance levels, and management objectives. The amount of old growth is generally similar to or greater than that of the existing condition. Old growth distribution that complements habitat connectivity is desired. Old growth is resilient to impacts that might result in the loss of old growth characteristics, such as insect infestations, wildfire, and drought. Old growth contains components that contribute to high quality habitat, including large or very large live trees with rot or broken tops, snags, downed woody material, and a diversity of tree size classes and canopy layers. A variety of old growth types are present.
Warm Dry-montane	4% (1% - 6%)	Old growth is dominated by Douglas-fir, often in large patches with an uneven-aged and irregular tree distribution. Stands are resilient to low severity disturbance. Other species such as juniper and aspen are valuable habitat components.
Warm Dry-Pine Savana	3% (1% - 6%)	Old growth is dominated by pure stands of large, fire-resistant ponderosa pine, in various patch sizes with an uneven-aged and irregular tree distribution. Stands are resilient to low severity disturbance.
Cool Moist	22% (16% - 27%)	Old growth in this broad potential vegetation type may be subject to wider pulses of availability, due to the preponderance of lodgepole pine and high severity low frequency disturbance regimes. Old growth includes spruce/fir or Douglas-fir dominated stands, often with dense canopy layers, as well as even-aged lodgepole pine.
Cold	32% (26% - 37%)	Old growth in this broad potential vegetation type generally consists of whitebark pine, Engelmann spruce, and subalpine fir, with stand-level resiliency and open structures desired in whitebark pine types versus spruce/fir types which may be denser and more layered.

¹ Old growth forests are defined specifically as forests that meet the minimum criteria established for the Northern Region of the Forest Service (see glossary) unless more current regionally-directed best available science becomes available.

² Existing condition shown is the mean percent of old growth (see glossary) with the 90% confidence interval shown in parenthesis. Source is Northern Region Summary Database, Forest Inventory and Analysis data, updated in 2015.

Kosterman and others (2018) showed that connectivity of mature forest structure was positively correlated with reproductive success of female lynx within a 50 percent core use area of the female's home range. The revised plan includes desired conditions for patch sizes in forested habitats to be maintained within the natural range of variation (FW-DC-VEGF 06). Kosterman and associates (Ibid) measured connectivity of mature forest in terms of "correlation length", which measures the extent of homogenous patch connectedness, rather than patch size per se. However, at the Forest landscape scale, patch size provides a good relative measure of habitat connectivity. To meet these desired conditions for patch size in the cool, moist forest types, the mature structural stage (mid- to late-seral) would be managed for large patch sizes (at least 500 acres) on a minimum of 16 percent of the landscapes that are capable of providing boreal forest types preferred by lynx. Current patch sizes of mature trees in cool, moist forest types are well above the desired range in mid-seral stage (represented by size class) of 5-15" DBH trees, with roughly 39 percent of this size class in patch size greater than 1,000 acres and another 6 percent in patch size between 500-1,000 acres. Conversely, the late-seral, or oldest/largest size class in the cool, moist forest types is currently well below the desired range for patch size, with less than 1 percent presence at patch sizes greater than 500 acres on the landscape. Early

seral stages (small trees, less than 5" DBH) are currently within the desired range for patch size. Plan components adopted from the NRLMD would help maintain habitat connectivity for lynx with a standard for vegetation management projects to maintain habitat connectivity in occupied LAUs (Standard ALL S1). Table 11 shows the current and desired conditions for forest patch size.

Table 11. Current and desired patch size distribution for three broad seral stages in each Northern Region Broad Potential Vegetation Type. Desired condition applies to lands with a forested potential vegetation, at the forestwide scale

Northern Region Broad PVT	Patch Size (Acres)	Early-Seral (0-5" DBH): Current ¹ (% of PVT)	Early-Seral (0-5" DBH): Desired ² (% of PVT)	Mid-Seral (5-15" DBH): Current ¹ (% of PVT)	Mid-Seral (5-15" DBH): Desired ² (% of PVT)	Late-Seral (>15" DBH): Current ¹ (% of PVT)	Late-Seral (>15" DBH): Desired ² (% of PVT)
Cold	<40	5%	3% - 6%	10%	11% - 16%	1%	11% - 14%
	40-100	1%	1% - 2%	5%	4% - 8%	0%	4% - 6%
	100-500	2%	1% - 5%	11%	6% - 14%	0%	7% - 11%
	500-1,000	1%	0% - 2%	5%	2% - 6%	0%	3% - 6%
	>1,000	1%	0% - 8%	59%	3% - 16%	0%	8% - 32%
Cool Moist	<40	6%	5% - 11%	13%	11% - 14%	2%	12% - 15%
	40-100	2%	1% - 4%	8%	4% - 6%	1%	4% - 5%
	100-500	3%	1% - 6%	14%	6% - 10%	1%	6% - 9%
	500-1,000	1%	0% - 2%	6%	2% - 5%	0%	2% - 4%
	>1,000	5%	0% - 8%	39%	4% - 15%	0%	8% - 19%
Warm Dry - montane	<40	7%	7% - 15%	14%	10% - 16%	3%	19% - 23%
	40-100	2%	2% - 4%	7%	2% - 4%	1%	6% - 9%
	100-500	2%	3% - 6%	13%	2% - 5%	1%	7% - 15%
	500-1,000	1%	1% - 3%	5%	0% - 2%	0%	2% - 6%
	>1,000	10%	1% - 10%	36%	0% - 4%	0%	4% - 23%
Warm Dry - pine savanna	<40	5%	1% - 11%	8%	0% - 9%	3%	5% - 6%
	40-100	2%	0% - 1%	4%	0% - 2%	1%	2% - 3%
	100-500	4%	0% - 4%	7%	0% - 5%	1%	4% - 7%
	500-1,000	3%	0% - 3%	4%	0% - 3%	1%	2% - 4%
	>1,000	24%	0% - 20%	32%	0% - 21%	1%	35% - 76%

¹Data Source: Northern Region Vegetation Map data based on 2015 imagery

² Desired Condition ranges based on the Natural Range of Variability analysis using the SIMPPLLE model.

Given these factors, under the revised plan, future management would likely be designed to break up the large, contiguous patches of medium-sized, closed canopy forest (mid-seral stage), leaving large, live trees (per FW-GDL-VEGF 03), and creating openings that would stimulate growth of both understory shrubs/small conifers and larger trees to contribute to the later seral stage patch sizes, thereby producing the multi-storied canopy that provides high-quality snowshoe hare habitat, which is consistent with direction adopted from the NRLMD to provide a mosaic of habitat conditions through time (Objective VEG O2). While regeneration harvest would not be precluded in lynx habitat, and in fact may be used to achieve a variety of management goals including timber volume, the strategy to move toward desired conditions for patch size would more likely be accomplished using intermediate silvicultural treatments, because the early seral stage (produced by regeneration harvest methods), is already within the desired range for both the amount and patch size conditions, while the late seral stage is currently below desired condition. NRLMD direction (Guideline VEG G1) supports projects designed to recruit conifer, hardwood and shrub regeneration to provide forage and cover for hares. Since mid-seral and late-seral stages are both within the "mature" forest structure (as measured by Holbrook et al. 2018 and Kosterman et al. 2018), conversion from mid-seral to late-seral stage would

neither decrease the amount of mature forest structure, nor reduce the connectedness of mature forest habitat at the landscape scale.

Collectively, coarse-filter vegetation plan components would ensure that future projects are designed to maintain or restore conditions that would contribute to the mature, multi-story foraging habitat component for lynx at the landscape scale. At the project level, plan components adopted from the Northern Rockies Lynx Management Direction would require consideration of habitat connectivity at the LAU scale (Objective ALL O1, Standard ALL S1), and would prohibit vegetation management actions that reduce snowshoe hare habitat in mature forest types, except for fuel reduction projects in WUI, which could occur on no more than 6 percent of the lynx habitat across the Forest (Standard VEG S6).

In addition to ensuring consideration for the mature forest structure preferred by lynx, the revised plan would also address the need for coarse, woody material to provide for lynx reproductive denning needs. Coarse-filter plan components include desired conditions that coarse woody debris is present and well-distributed across the Forest (FW-DC-SOIL 01-03), followed with guidelines containing specific retention levels for coarse woody materials following vegetation management activities (FW-GDL-SOIL 07). Forested vegetation plan components also address snag management (FW-DC-VEGF 05; FW-GDL-VEGF 03), which would provide recruitment materials to contribute to lynx denning habitat over time. Guideline (VEG G11) adopted from the NRLMD provides complimentary direction regarding the distribution of coarse woody debris to provide adequate representation for lynx denning habitat. Similarly, the revised plan contains management direction to maintain healthy deciduous woodlands and shrublands (FW-DC/GDL-VEGNF), which can provide important secondary habitat for lynx. Additionally, the revised plan includes a comprehensive set of detailed and specific plan components for protection of riparian areas (FW-DC/STD/GDL RMZ), which can function as snowshoe hare habitat (lynx foraging habitat) and reproductive denning habitat for lynx in forested areas, and also provide potential travel corridors for lynx to move between patches of boreal forest habitat.

Under the revised plan, coarse filter vegetation management direction would ensure consideration of lynx habitat needs relative to management actions. Additional plan components regarding acceptable land uses in designated areas, and new forest plan allocations would limit the degree to which management actions could affect lynx habitat. Designated areas are those identified and managed to maintain a unique special character or purpose. Those addressed here are designated by authorities beyond the Forest Service, including wilderness areas, of which there are two on the CGNF (Absaroka-Beartooth and Lee Metcalf), wilderness study area (Hyalite-Porcupine-Buffalo Horn), and inventoried roadless areas, all of which are designated by statute. Such designations are not directly affected by forest plan allocations, but forest plans can inform future area designations made by Congress, by ensuring that certain values (e.g. wilderness character) are maintained. Land allocations on the other hand, are developed in the forest planning process, with associated plan direction for managing areas identified in allocations. Land allocations included in the Custer Gallatin revised plan include recommended wilderness areas, eligible wild and scenic river corridors, backcountry areas, key linkage areas, recreation emphasis areas and the Stillwater mining complex.

Each category of land use allocation has a distinct set of plan components that restrict certain management actions while encouraging or emphasizing others. Plan components may vary by allocation type, as well as by geographic location. For example, plan components are the same for all recommended wilderness areas, but may differ between backcountry areas based upon geographic location. Very broadly speaking, land allocations for recommended wilderness, backcountry areas, and

key linkage areas emphasize natural processes, and consequently contain more restrictions on human uses, whereas recreation emphasis areas and the Stillwater complex focus more on providing for human uses, with less restrictions on management. Here, the focus will be on plan allocations that provide greater protections to demonstrate how the revised plan addresses first tier impacts to lynx. Remaining plan allocations are incorporated later in the BA to address second tier impacts to lynx.

Forest plan allocations often spatially overlap with existing land use designations for wilderness study area and/or inventoried roadless areas, and there is overlap between the designations as well. For example, all of the wilderness study area is also inventoried roadless area. Designated wilderness areas stand alone, having no overlap with other designations or forest plan allocations. Unless or until Congress enacts new legislation, the wilderness study area will be managed per the Wilderness Study Act of 1977, and inventoried roadless areas will be managed as per the 2001 Roadless Area Conservation Rule. However, where designated areas and forest plan allocations overlap, the more restrictive guidance in the plan would apply.

The revised plan would impose land use restrictions in recommended wilderness areas, backcountry areas, and key linkage areas that would protect habitat conditions for lynx by limiting the means of management actions that could occur, and also by limiting permanent developments and motorized/mechanized access to these areas by varying degrees. In general, recommended wilderness has the greatest level of management restrictions, including no new roads, energy/utility corridors, or developed recreation sites, and no timber harvest allowed (FW-DC/STD/GDL/SUIT-RWA). These plan components are consistent with direction adopted from the NRLMD objectives to manage recreational uses, mineral and energy developments, to minimize impacts on lynx habitat (Objectives HU O2 and O5). Restrictions associated with these plan components would result in more natural conditions resulting primarily from ecological processes to which lynx have evolved. However, 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 ecological restoration purposes, including low impact habitat improvement projects (FW-SUIT-RWA 03, 04). 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. Also, inability to pre-treat high fuel loads with mechanical timber removal could affect the ability to effectively use prescribed fire for restoration purposes. 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 for some restoration projects, resulting in budgetary constraints that could also limit restoration projects.

Backcountry area is a new forest plan allocation in lynx habitat on the Custer Gallatin National Forest. These areas would be maintained as generally undeveloped or lightly developed with no or few roads or other permanent human developments (FW-DC/STD/GDL/SUIT-BCA; see also plan components for individual backcountry areas by Geographic Area in the plan). As with recommended wilderness, backcountry areas often spatially overlap with wilderness study area and/or inventoried roadless areas, and the more restrictive land use direction applies in areas of overlap. With an emphasis on low development, the backcountry areas would limit new permanent development and some types of use, resulting in less habitat fragmentation and lower disturbance from noise and human presence than other areas without special allocations. However, land uses are somewhat less restricted in backcountry

areas than in recommended wilderness areas. For example, temporary roads may be allowed for resource management, but only in the Pryor GA, which is peripheral lynx habitat. No new roads, temporary or permanent, could be constructed in backcountry areas elsewhere in lynx habitat, but existing mechanized and motorized uses were generally continued in backcountry areas, where such uses would be removed and/or prohibited in recommended wilderness.

Key linkage areas are another new allocation under the revised plan. These areas, and associated plan components were added to formalize habitat protection measures in areas recognized as highly significant in providing habitat connectivity for wildlife, including lynx. Generally speaking, key linkage areas would limit human disturbance (FW-DC-WL 07, FW-STD-WL 02, FW-SUIT-WL 01), and restrict future infrastructure development to administrative purposes, while prohibiting additional infrastructure designed solely to accommodate increased recreation use (FW-GDL-WL 03, 04). Key linkage areas would affect vegetation management with requirements for design criteria to restore, maintain or enhance habitat connectivity for wildlife (FW-GDL-WL 02) and timing restrictions limiting the duration of vegetation management projects (FW-GDL-WL 05) to limit disturbance impacts. Forest plan allocations and associated management direction for key linkage areas is consistent with, and complementary to components adopted from the NRLMD for vegetation management actions to maintain or restore lynx habitat connectivity (Objective ALL O1, Standard ALL S1).

Table 12 demonstrates by revised plan geographic area (and associated lynx habitat category) the proportions of lynx habitat that are most protected by designated areas (wilderness, wilderness study, and inventoried roadless), combined with new forest plan allocations of recommended wilderness, backcountry areas and key linkage areas. Since these areas can overlap spatially, overlap areas are only counted in one category, typically by the forest plan allocation area, so as not to “double count” or otherwise over-represent protected acres. For example, proportions reported for wilderness study areas and inventoried roadless areas are those acres outside of forest plan allocations. Table 13 shows total proportions protected in occupied vs unoccupied lynx habitat.

Table 12. Potential Lynx Habitat within management restriction areas by Geographic Area –NFS Lands

AB GA Core/Occupied	Existing Plans			Revised Plan		
	Lynx Hab ¹	Non Hab ²	Total ³	Lynx Hab ¹	Non Hab ²	Total ³
Designated Wilderness	59	71	68	59	71	68
Inventoried Roadless	26	17	20	26	17	20
Recommended Wilderness	1	< 1	< 1	< 1	0	0
Backcountry Area	0	0	0	< 1	2	1
Total Designations	86	88	88	86	90	89
MHG GA Secondary/Occupied	Existing Plans			Revised Plan		
	Lynx Hab ¹	Non Hab ²	Total ³	Lynx Hab ¹	Non Hab ²	Total ³
Designated Wilderness	12	23	17	12	23	17
Wilderness Study Area	18	18	18	3	3	3
Inventoried Roadless	31	25	28	24	21	23
Recommended Wilderness	2	3	3	11	13	12
Backcountry Area	0	0	0	13	10	12
Key Linkage Area	0	0	0	2	1	1
Total Designations	63	69	66	65	71	68

BBC GA Secondary/Unoccupied	Existing Plans			Revised Plan		
	Lynx Hab ¹	Non Hab ²	Total ³	Lynx Hab ¹	Non Hab ²	Total ³
Inventoried Roadless	56	72	62	44	39	42
Recommended Wilderness	0	0	0	2	10	5
Backcountry Area	0	0	0	11	24	16
Key Linkage Area	0	0	0	1	2	2
Total Designations	56	72	62	58	75	65
Pryor Mountain GA Peripheral/Unoccupied	Existing Plans			Revised Plan		
	Lynx Hab ¹	Non Hab ²	Total ³	Lynx Hab ¹	Non Hab ²	Total ³
Inventoried Roadless	5	5	5	4	5	5
Recommended Wilderness	8	9	9	16	26	24
Backcountry Area	0	0	0	42	21	25
Total Designations	13	14	14	62	52	54

¹Proportion of Total Lynx Habitat; ²Proportion of Total Non-Habitat; ³Proportion of Geographic Area

Table 13. Potential Lynx habitat within management restriction areas summarized – NFS Lands

Occupied Habitat vs. Unoccupied Habitat	Existing Plans			Revised Plan		
	Lynx Hab ¹	Non Hab ²	Total ³	Lynx Hab ¹	Non Hab ²	Total ³
Occupied in Des/Alloca	74%	83%	79%	75%	85%	81%
Unoccupied in Des/Alloca	51%	47%	49%	58%	65%	62%
Total	70%	80%	76%	73%	83%	79%

¹Proportion of Total Lynx Habitat; ²Proportion of Total Non-Habitat; ³Proportion Occupied Unoccupied

As can be seen from Table 12 and table 13 above, land use allocations in the revised plan would add some level of land use restrictions in areas where lynx may be present on the CGNF. Larger increases in forest plan allocations occur in unoccupied lynx habitat (BBC and Pryor GAs). However, land use restrictions already occur at notably higher proportions in occupied lynx habitat (AB and MHG GAs), largely due to the presence of large, designated wilderness areas (Absaroka-Beartooth, Lee Metcalf) in these parts of the Forest.

In concert with the revised LCAS (Interagency Lynx Biology Team 2013), this biological assessment will focus on first and second tier anthropogenic influences on lynx and lynx habitat, considering the relationship between these influences and the proposed action. First tier factors include vegetation management, wildland fire management, habitat fragmentation, and climate change.

Tier 1: Effects of Fire 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. Direction adopted from the NRLMD supports vegetation management that mimics or approximates natural succession and disturbance processes, including fire use (Objectives VEG O1, O3). The revised plan contains complementary coarse filter 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 (FW-DC-FIRE 01), with an objective for wildland fire to occur at a larger scale than has been the case under existing plans (FW-OBJ-FIRE 02). Wildland fire has potential to affect habitat in ways that are negative, neutral or beneficial to lynx.

Unless a broad scale assessment has been completed that substantiates different historic level of stand initiation structural stage lynx habitat, forest plan direction adopted from the NRLMD caps the amount of lynx habitat that can be converted to an early stand-initiation stage by vegetation management including prescribed fire, to no more than 30 percent of mapped lynx habitat within an LAU (NRLMD Standard VEG S1). The revised plan includes a broad scale assessment of the natural range of variation for forest structure. This assessment indicates that the stand initiation stage (seedling/sapling trees < 5 inches DBH) ranges from 5 to 35 percent of the cool moist forest types on the Custer Gallatin (FW-DC-VEGF 03 – Table 7), which is consistent with existing direction in NRLMD Standard VEG S1. Therefore, natural processes and management actions combined may produce early stand initiation stage habitat below, at, or above 30 percent of the mapped lynx habitat, but once the 30 percent cap is reached or exceeded, no additional lynx habitat may be regenerated by vegetation management actions, including prescribed fire. This direction allows for some conversion of lynx habitat to early successional stages to perpetuate the cycle of diversity by mixing young regenerating forest with mature and older multi-story forest in lynx habitat.

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. Such events are expected to provide sustainable habitat for lynx over time and contribute to recovery of the species. Fires that burn in warm, dry forest types, shrublands and grasslands have little impact on lynx or snowshoe hares.

Fire and fuel management in the wildland urban interface can have impacts on lynx habitat, since the desired condition is for vegetation that supports low-intensity fire in order to protect infrastructure and other values at risk (FW-DC-FIRE 02), which is contrary to structural conditions that provide high horizontal cover for snowshoe hares. Hazardous fuel management would occur in the wildland urban interface to achieve this desired condition. Fuel treatments in the wildland urban interface are expected to occur under the revised plan, with objectives for hazardous fuel mitigation projects at a minimum of about 6,000 acres per year (FW-OBJ-FIRE 01). 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. Plan components adopted from the NRLMD allow exemptions to standards designed to protect lynx habitat, but only for the purpose of hazardous fuel reduction within the wildland urban interface to protect communities at risk. The direction limits such projects so that no more than 6 percent of occupied lynx habitat on the Forest may be affected over the life of the plan (NRLMD Standards VEG S1, S6).

Outside of the wildland urban interface, direction adopted from the NRLMD would encourage prescribed fire use (Objective VEG O3) 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 in the stand initiation (advanced regeneration) stage. Plan components adopted from the NRLMD would restrict prescribed fire projects outside of WUI that reduce multi-storied mature snowshoe hare habitat, to a small list of very narrow purposes (NRLMD Standard VEG S6).

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 travel 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. The revised plan includes a guideline to use minimum impact suppression tactics in sensitive habitat for at-risk species (FW-GDL-FIRE 03), 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 (NRLMD Guideline VEG G4). 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 overall impact on lynx habitat (USDI FWS 2000).

Tier 1: Effects of 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).

The revised plan contains desired conditions for timber production that supports economies as well as sustaining ecosystem health by creating environments that are resistant to natural disturbances (FW-DC-TIM 01). Plan components require that mechanical harvest for purposes of timber production occur only on lands classified as suitable for timber production (FW-STD-TIM 01). Under the existing forest plans, the area suitable for timber production (also referred to as the "suitable base") includes about 17 percent of the National Forest System acres in the montane geographic areas (where lynx may be present). Under the revised plan, the area suitable for timber production decreases to about 13 percent of montane geographic areas. 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 amount (acres) of lynx habitat within the suitable timber base is even less than indicated for the entire montane ecosystem and individual geographic areas. Table 14 and table 15 show the proportion of occupied and unoccupied lynx areas suitable for timber production, as well as the proportion of potential lynx habitat (boreal forest types) within the suitable timber base by geographic area.

Table 14. Acres of all NFS lands classified as suitable for timber production

Lynx Habitat Category	Total Acres NFS Lands	Existing Plans Suitable Timber	Revised Plan Suitable Timber
Occupied	2,165,156	14%	12%
Unoccupied	280,215	33%	23%
Total	2,445,371	17%	13%

Table 15. Potential Lynx Habitat (boreal forest) in suitable timber base

Geographic Area and Lynx habitat class	Total Acres Lynx Habitat	Existing Plans Lynx Habitat in Suitable Timber	Revised Plan Lynx Habitat in Suitable Timber
AB: Core	399,398	13%	11%
MHG: Secondary	447,208	35%	29%
Occupied Total	846,606	25%	21%
BBC: Secondary	123,377	42%	36%
Pryors: Peripheral	13,707	83%	28%
Unoccupied Total	137,084	46%	35%
Lynx Habitat Total	983,690	28%	23%

Table 14 and table 15 show that not only would the total amount of NFS lands in the suitable timber base decline in the revised plan, but the amount of potential lynx habitat types that are suitable for timber production would decrease under the revised plan as well. 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 (FW-GDL-TIM 03). Timber harvest, whether for timber production, or for other resource purposes, has the potential for short-term impacts to lynx, with summer snowshoe hare habitat expected to regenerate within 5 to 15 years post-harvest, and winter hare habitat expected to regenerate within 16 to 40 years after harvest. Direction adopted from the NRLMD would emphasize projects designed to recruit a high density of conifers, hardwoods and/or shrubs where lynx habitat is lacking these components (Guideline VEG G1). Over time, harvested areas in potential lynx habitat generally would be expected to provide a matrix of habitat structure required by lynx.

Any future timber harvest proposed in lynx habitat would be subject to revised plan requirements adopted from the Northern Rockies Lynx Management Direction (NRLMD Standards VEG S1, S2, S5 and S6), which would prohibit vegetation management projects (including timber harvest) that reduce or remove existing snowshoe hare habitat, except for fuels reduction projects in the wildland urban interface. Timber harvest could affect lynx habitat when used for timber production (within the suitable base) as well as when used for other resource benefits, but only in areas not currently producing adequate horizontal cover to provide suitable snowshoe hare habitat. Timber harvest in such conditions may have beneficial, neutral or negative effects on lynx habitat, depending on the existing structure, type of harvest implemented, and other environmental conditions. NRLMD standard VEG S1 limits the amount of regeneration harvest that, combined with natural and prescribed fire, would set lynx habitat back to an early stand initiation stage, to no more than 30 percent of the total mapped lynx habitat in any single LAU. NRLMD standard VEG S2 limits the effects of regeneration harvest to no more than 15 percent of the lynx habitat in a LAU in a ten year period. The NRLMD contains exemptions to standards

VEG S1, S2, S5 and S6 for fuel reduction treatment in the wildland urban interface to protect communities at risk, 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. However, standards adopted from the NRLMD caps the amount of lynx habitat that can be altered for fuel reduction in the wildland urban interface using exemptions, to no more than 6 percent of the occupied mapped lynx habitat over the life of the plan.

In 2007, Forest Plans for eighteen national forests (including the Custer and Gallatin) were amended to incorporate the Northern Rockies Lynx Management Direction and this process went through formal consultation with the US Fish and Wildlife Service (Service). The Service issued a biological opinion and incidental take statement regarding the effects of the NRLMD on lynx (USDI FWS 2007). The incidental take statement anticipated take in the form of harm (management actions that reduce snowshoe hare habitat) due to vegetation management standards in the NRLMD (Standards VEG S1, S2, S5 and S6) that include exemptions for treating hazardous fuels in the wildland urban interface to protect communities at risk. Invoking these exemptions for project implementation was predicted to affect up to six percent of occupied lynx habitat over a ten-year period. At that time, the Custer and Gallatin were not yet formally combined. Based upon the best habitat mapping information at the time, the Custer Forest estimated that the 6% exemption for fuels treatments in WUI could impact approximately 13,800 acres of lynx habitat, whereas the Gallatin Forest estimated the 6% exemption could affect up to 52,200 acres of lynx habitat. These figures were based on mapped lynx habitat in both occupied and unoccupied lynx areas. In 2017 when the 2007 incidental take statement expired, the Forest Service requested an extension or amendment of the 2007 incidental take statement (USDA 2017).

Since 2007, new science and technology have been applied to update lynx habitat mapping on the Custer and Gallatin portions of the Forest (described above under Environmental Baseline). As per recommendations in the NRLMD (USDA 2007), Biological Opinion for the NRLMD (USDI FWS 2007), and the LCAS (ILBT 2013), updated mapping techniques were used to produce new baseline estimates of potential (i.e. mapped) lynx habitat, which were supplied for the 2017 request for extension or amendment of the incidental take statement. In 2017, the Custer portion of the Forest was estimated to have approximately 138,768 acres of total lynx habitat, of which 129,417 (93%) were in occupied areas. The Gallatin portion was estimated to have a total of 833,002 acres of potential lynx habitat, of which 732,314 (88%) are in occupied areas. The amended incidental take statement was based on occupied lynx habitat, resulting in anticipated acres of habitat exempted for treatment in WUI (6%) at 7,765 acres for the Custer, and 43,938 acres for the Gallatin, for a total of 51,703 acres for the Custer Gallatin. Combined, the two Forests were predicted to affect a total of 51,703 acres using the 6% exemption for fuel treatment in WUI. As of 2017, the Forest reported a total of 2,676 acres of proposed (under a signed decision) or implemented treatment subject to the 6% exemption, indicating that the Forest had proposed or treated only about 5% of the anticipated treatment allowed for the NRLMD exemptions (USDA 2017). Since then, mapped lynx habitat has again been updated, based on closer scrutiny of vegetation data for forest plan revision, combined with updated information for projects based on site specific data collection and project implementation. Current best estimates indicate a total of approximately 846,606 acres of potential lynx habitat in occupied areas of the Custer Gallatin (combined) Forest, putting the 6% exemption figure at 50,796 acres for the combined CGNF.

To date, approximately 3,700 acres of snowshoe hare habitat have been or will be affected by implementation of signed decisions, which is roughly 7 percent of the predicted amount to be affected under the NRLMD exemptions, and less than one half of one percent of the total estimated acres of potential lynx habitat in occupied areas of the Forest. Revised plan objectives call for a minimum of 6,000 acres of hazardous fuels treatment per year over the life of the plan (FW-Obj-FIRE 01). Not all fuel reduction projects would occur in lynx habitat, and not all of those that could occur in lynx habitat would require use of the exemptions for treating snowshoe hare habitat. Based on revised plan objectives, it is reasonable to assume that fuel treatment projects in lynx habitat using the NRLMD exemptions would be accelerated relative to projects implemented under existing plans. However, such projects would not exceed the remaining 47,096 acres of snowshoe hare habitat treatment allowed in the total exemptions provided in the NRLMD over the life of the plan.

Plan components adopted from the NRLMD also contain exceptions to Standards VEG S5 and S6 that allow for some precommercial thinning or other treatment that would reduce snowshoe hare habitat under certain circumstances, such as removing fuel around administrative sites or other buildings, for research studies, to achieve desired outcomes based on new information, conifer removal to enhance aspen, whitebark pine restoration, and in the case of multi-story mature stands, incidental removal of understory trees during salvage harvest operations. Vegetation management projects utilizing exceptions to NRLMD VEG S5 and VEG S6 in occupied lynx habitat are anticipated to be small scale, and estimated to affect a total of only 2,300 acres of lynx habitat across the entire Forest. To date, only 40 acres of lynx habitat have been treated under these conditions on the Custer Gallatin. When added to the exemptions for fuel treatment in the WUI, the exceptions raise the possible amount of total snowshoe hare habitat affected from 6 percent to roughly 6.3 percent of the total potential lynx habitat on the Forest.

Plan components with associated exemptions adopted from the NRLMD only apply to occupied lynx habitat. Potential lynx habitat exists in unoccupied areas as well, and it is likely that vegetation management implemented under the revised plan will affect lynx habitat in these areas. The most current mapping efforts predict a total of 137,084 acres of potential lynx habitat in unoccupied areas on the Custer Gallatin National Forest. To date, only 119 acres of potential lynx habitat has been affected by vegetation management in unoccupied areas. This treatment met all NRLMD provisions that apply in occupied lynx habitat. The NRLMD states that projects in unoccupied lynx habitat should consider the goals, objectives, standards and guidelines that apply in occupied lynx habitat. Assuming that consideration of NRLMD components results in similar management of lynx habitat in unoccupied areas, then 6 percent of lynx habitat is a reasonable estimate for future effects of vegetation management projects in unoccupied habitat as well. This assumption results in approximately 8,100 acres of potential future projects that could reduce snowshoe hare habitat in unoccupied areas, or that would fall under the NRLMD exemptions, should the currently unoccupied areas become occupied by lynx.

In addition to Northern Rockies Lynx Management Direction restrictions, forestwide plan components in the revised plan would require that harvest units be designed to reflect natural terrain patterns (FW-STD-TIM 05), with maximum size limits on openings created by timber harvest (FW-STD-TIM 08), and design criteria that include considerations for wildlife habitat (FW-STD-TIM 04). 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 (FW-STD-TIM 10), 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, stand initiation stage 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 (NRLMD Standards VEG S5, S6). 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 of 6 percent as described above.

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 removal of dead and dying trees could reduce the quality and/or availability of existing and potential future denning habitat. Direction adopted from the NRLMD specifies that denning habitat should be distributed in each LAU with pockets of large woody debris, requiring retention of coarse woody debris where it may be lacking (Guideline VEG G11). The revised plan includes a complementary guideline that would require retention of a certain amount of coarse woody debris in vegetation treatment units (FW-GDL-SOIL 07). Compared to existing plans, the plan components for coarse woody debris in the revised plan would be more ecologically relevant, as they are customized to potential vegetation types to reflect a more natural range of variation. In addition to plan components for coarse woody debris, the revised plan include standards and guidelines that would limit salvage harvest in riparian management zones (FW-STD-RMZ 02 and FW-GDL-RMZ 05, 08), and guidelines (FW-GDL-TIM 01, 02) that would require retention of live, dying or dead trees in post-burn salvage units. Finally, the revised plan contains plan components for retaining snags (FW-DC-VEGF 05, FW-GDL-VEGF 03), which are standing dead trees that could eventually contribute coarse woody debris for lynx denning habitat. Under the revised plan, direction for snag management would

require more and generally larger snags to be left in treatment units where snags may be lacking, compared to existing plans.

Ultimately, the effects of vegetation management would be negligible compared to effects of natural disturbance processes on lynx habitat. 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 the effects of management actions implemented under the revised forest plan would be minor relative to natural processes. A landscape dynamic simulation model (SIMPPLLE) 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 in the plan, 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 scale used by lynx that could be attributed to management actions. This modeling 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 (figure 8). 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 is the predicted trends, not the actual numbers generated.

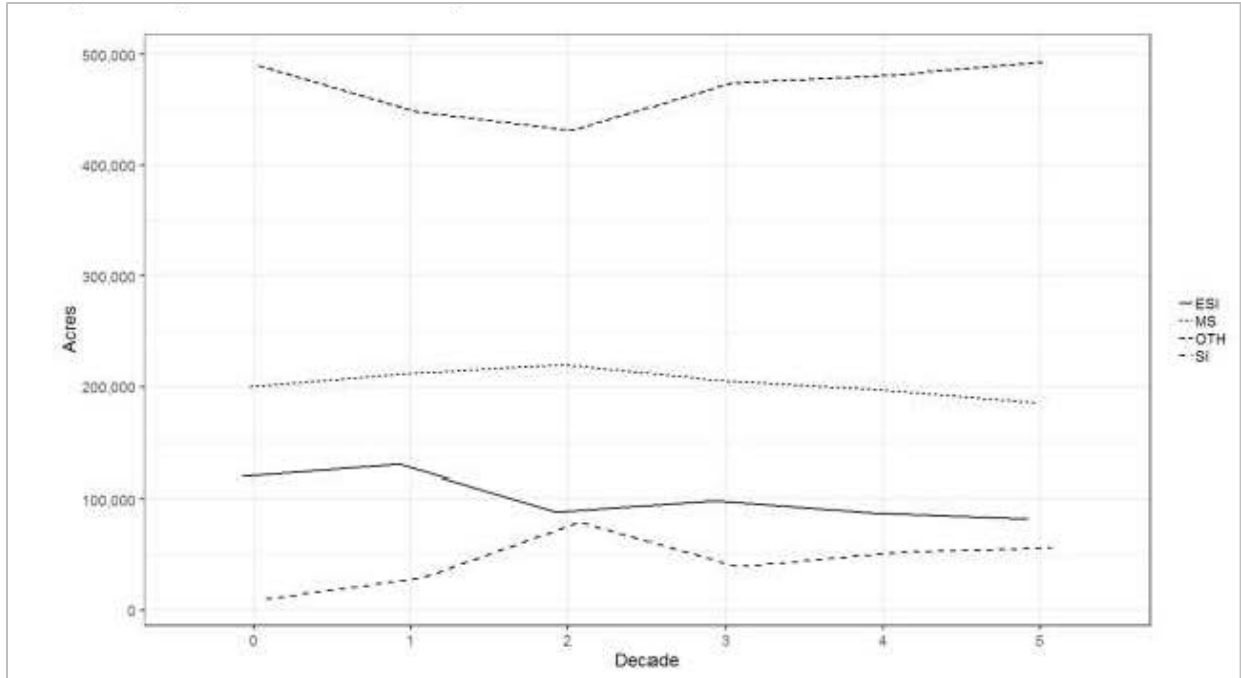


Figure 8. Predicted lynx habitat structure by decade

Tier 1: Effects of Habitat Fragmentation

Habitat fragmentation is another first tier anthropogenic influence identified for consideration in the LCAS (ILBT 2013). The revised plan adopts components from the Northern Rockies Lynx Management Direction maintain or restore lynx habitat connectivity within and between LAUs and in linkage areas (NRLMD Objective ALL O1, Standard ALL S1, Guideline ALL G1, Guideline HU G7, Objective LINK O1, Standard LINK S1, Guidelines LINK G1 and G2). Wildlife and Forested Vegetation plan components to manage habitat/vegetation within the natural range of variation (FW-DC-WL 03; FW-DC-VEGF 01) provide a basic foundation for minimizing habitat fragmentation. The revised plan further addresses this factor (for lynx and other species) in response to the 2012 Planning Rule requirement that the plan must include components to maintain or restore the ecological integrity of ecosystems, including 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). To address the planning rule requirement to provide for connectivity, the revised plan takes 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.

To tackle the issue of evaluating habitat connectivity for multiple wildlife species including lynx, the Forest Service partnered with the Center for Large Landscape Conservation and developed a modeling framework specific to the Custer Gallatin Forest (Williamson, et al. 2019). 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.

The CGNF connectivity model generated a series of paths connecting core habitats using different assumptions about animal movement behavior. The model considered habitat preferences, such as those demonstrated by forest carnivores such as lynx (i.e. forested habitat specialist). Predicting random movement through preferred habitats assumed an animal has imperfect knowledge of its surroundings, with results more reflective of dispersal movements outside of home range areas. Paths predicting deliberate movement between core habitats in an optimal fashion assumed an animal has perfect knowledge of its surroundings and produced model outputs more representative of experienced individuals making daily movements or seasonal migrations within an established home range. The optimal versus random movement patterns predicted by the modeling process informed an analysis to evaluate plan components' potential to minimize habitat fragmentation, and provide habitat connectivity for residential use by lynx, as well providing habitat for transient use by dispersing individuals. Reflecting habitat connectivity modeling results, the revised plan identifies areas of known, or intuitive importance for wildlife movement as key linkage areas.

The revised plan specifically states desired conditions for landscape patterns throughout the Custer Gallatin to provide habitat connectivity for wildlife, particularly wide-ranging species such as medium to large carnivores and wild ungulates (FW-DC-WL 05—07). 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 these components is that by providing adequate conditions for larger-bodied, wide-ranging species such as lynx, habitat conditions will also be met for smaller-bodied species with shorter dispersal capabilities, such as snowshoe hares. 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. To help achieve and maintain this desired condition for all wildlife, the revised plan contains a guideline that management actions should not create movement barriers to wide ranging species, except where necessary to provide for human or wildlife safety (FW-GDL-WL 01). Plan components adopted from the NRLMD contain complementary direction specific for lynx to maintain or restore lynx habitat connectivity (Objective ALL 01), with a mandate that new or expanded permanent development and vegetation management projects must maintain habitat connectivity within and between lynx analysis units (Standard ALL S1).

While certain conditions on the ground may impede movement for lynx, there are few management actions in which the Forest Service engages that would create a true barrier to lynx movement, since lynx have the ability go over, under, through, across, or around most obstacles. Some authors (Ruediger et al. 2000, Vanbianchi et al. 2018) have reported that dispersing lynx (i.e. those leaving their natal area or existing home range in search of new home range) are known to travel through suboptimal conditions, including movement through large areas of limited forest cover. 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. The revised plan would ensure that management actions that could alter the natural environment would be evaluated for possible impacts on movement patterns of all wide-ranging species and lynx specifically within or between lynx

analysis units (FW-GDL-WL 01; NRLMD Standard ALL S1). These components would require mitigation for those actions that would not maintain or restore habitat connectivity for wildlife, and particularly for lynx. On the other hand, the revised plan guideline (FW-GDL-WL 01) 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. These measures would also be supported by components adopted from the NRLMD to reduce impacts to lynx associated with highway construction or reconstruction, where methods could include fencing, underpasses or overpasses (Guideline ALL G1).

The NRLMD defines linkage areas for lynx as areas that provide connectivity between blocks of lynx habitat. Linkage areas occur both within and between geographic areas, where basins, valleys, or agricultural lands separate blocks of lynx habitat, or where lynx habitat naturally narrows between blocks (NRLMD Glossary – *Linkage area*). Figure 1-1 of the NRLMD shows general locations of linkage areas for lynx. The NRLMD indicates that the greatest risk to impeding connectivity for lynx is in relation to roads and highways (ROD p. 31). Consequently, linkage areas (per Figure 1-1 of the NRLMD) are located where lynx would have to cross highways within or outside the Forest boundary, in order to move between blocks of lynx habitat. Plan components adopted from the NRLMD (Objective ALL O1, Standard ALL S1, Guideline ALL G1) would ensure consideration and possible mitigation for future projects that could impact lynx movement within and between LAUs. Some of the linkage areas identified in Figure 1-1 of the NRLMD are associated with lands outside the Forest boundary, where the Forest Service has no authority to either limit or dictate management actions that could affect lynx habitat connectivity. However, the revised plan includes goals to work with other agencies and landowners to cooperatively manage habitat and provide for connectivity across administrative boundaries, acquire non-federal lands or seek conservation easements where needed to maintain or restore connectivity, and work with highway administrators to reduce vehicle collisions with wildlife (FW-GO-WL 02, 03, 05; FW-GO-LAND 01, FW-GO-RT 03). Plan components adopted from the NRLMD encourage similar conservation measures specific to lynx (Objective LINK O1, Standard LINK S1, Guideline LINK G1; Objective HU O6). Collectively, this direction would ensure that lynx habitat connectivity and potential to reduce impacts to lynx from highway crossings, are considered in future project design criteria as well as cooperative efforts between the Forest Service and other agencies and landowners.

In addition to the general direction described above, for the first time, the revised Custer Gallatin plan would include land use allocations for key linkage areas with associated plan components. Key linkage areas in the revised plan are designed to support wildlife movement, and are located near the Forest boundary where wildlife movement is desirable for genetic exchange between blocks of public land, but where such movement may be restricted by permanent development such as highways, railroads, agricultural lands and residential areas (Revised Plan Glossary: Linkage areas). 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 plan components. Some of the highest quality areas for habitat connectivity are already in designated areas, such as wilderness, inventoried roadless, or other areas 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 these areas provides the protection needed to maintain habitat connectivity, and therefore additional, fine-filter plan components were not necessary. Accordingly, most areas of the Custer Gallatin identified as highly important for habitat connectivity for forest specialists such as lynx, 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 MHG GA and the west side of the Bridger Range in the BBC GA (see Figure 2 and Figure 4), which includes one of the linkage areas identified in Figure 1-1 of the NRLMD. Revised plan key linkage 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 forested habitat 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 the revised plan 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 (low development) lands in a north-south (or vice versa) fashion between larger contiguous blocks of relatively undeveloped 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.

Under the revised plan, new recreation developments, such as roads, trails, campgrounds, etc. would not be allowed for the purpose of increasing recreation use in key linkage areas, but could be constructed to address on-going or imminent ecological resource concerns (FW-GDL-WL 03). 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. New permanent facilities or structures needed for administrative purposes (e.g. livestock fencing) would be designed and located to minimize disruption to wildlife movement patterns (FW-GDL-WL 04).

Key linkage areas would be managed in accordance with guidelines that allow for vegetation management with consideration to maintain or enhance habitat connectivity for wildlife (FW-GDL-WL 02), 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 (FW-GDL-WL 05). 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 research for large-bodied, wide-ranging animals such as elk and grizzly bears, which has shown that these species will avoid areas of high disturbance 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. Most research on wildlife displacement from management actions, including that cited above, 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. Finally, the revised plan includes a standard (FW-STD-WL 02) that would preclude nighttime recreation events within the key linkage areas to provide an additional temporal aspect of limiting disturbance factors that could influence wildlife movement through the area.

Other land use designations or forest plan allocations overlap with the key linkage areas. Much of the northern key linkage area in the Bridger Range is also inventoried roadless, while a portion at the far north end would also be allocated as a backcountry area (Blacktail Peak BCA). In areas of dual designation and/or multiple forest plan allocations, the more restrictive direction would apply. Collectively, these restrictions would provide better security for wildlife movement within the key linkage areas than under the existing plan. Outside of key linkage areas, the configuration of existing designated wilderness, wilderness study area, and inventoried roadless areas, combined with revised plan allocations for recommended wilderness and backcountry areas, provide a well-connected system of large blocks of habitat with land use restrictions that would help maintain habitat connectivity, and thereby minimize habitat fragmentation impacts for lynx over the life of the forest plan.

In addition to these very specific wildlife plan components affirming the Forest's commitment to proactively manage for habitat connectivity, the revised plan contains a host of components for other resource areas that would also contribute to habitat connectivity and minimize fragmentation. The revised plan addresses spatial connectivity between watersheds (FW-DC-WTR 02), including components for riparian vegetation to provide for life cycle needs, habitat connectivity and movement corridors for terrestrial, aquatic, and avian species (FW-DC-WTR 10; FW-GDL-RT 05). Desired landscape scale patch size, configuration and composition is also spelled out for forested habitats important to lynx, snowshoe hares, and other species (FW-DC-VEGF 06). The revised plan includes specific guidelines to maintain habitat connectivity in old growth forest (FW-GDL-VEGF 01, 02), which can provide both foraging and denning habitat for lynx. Finally, the revised plan contains a desired condition for consolidated land ownership within the Forest boundary to help maintain or restore habitat connectivity for wildlife (FW-DC-LAND 01).

In summary, whereas existing plans contain direction for elements such as habitat security and other factors that help reduce habitat fragmentation effects, the revised plan introduces a more integrated approach that includes an entire suite of plan components addressing a variety of key ecological and social conditions, including new forest plan allocations for key linkage areas. Collectively, revised plan components, including those adopted from the NRLMD, clearly and affirmatively state the Forest's commitment to maintain habitat connectivity for wildlife (including lynx and snowshoe hares) both within the Forest boundary as well as across the broader landscape.

Tier 1: Effects of Climate Change

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). As such, climate

change has been identified in the LCAS (ILBT 2013) as a first-tier human-caused driver with potential to influence lynx habitat in the continental United States. A number of studies predict that 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 (Ibid). 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).

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 2007). 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, ILBT 2013). These food sources may be found in any stage of lynx habitat, and are less likely to be influenced by climate change. 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 (ILBT 2013) that produce the coarse woody material used by lynx as denning structure.

Hansen and others (2018) looked specifically at the CGNF portion of the GYA to assess vulnerability to climate change. They noted that the cool, moist vegetation types highly suitable for lynx and snowshoe hares has broad distribution across the GYA portion of the Forest. This study projected increased presence of Douglas fir in potential lynx habitat due to warming temperatures and less frost during the growing season. At the same time, lodgepole pine, subalpine fir and spruce are projected to decrease due to drying soils and more frequent fires. The timing and extent of such projections are imprecise, but rather predicted to occur at a relatively broad scale in coming decades, indicating potential for such changes to become notable over the life of the plan. Natural ecological processes are the primary drivers of climate, precipitation, and resulting forest species composition. However, revised plan components to manage forested habitats within their natural range of variation would help minimize management contributions to negative impacts associated with climate change.

The Forest Service recognizes the vital role that our nation's forests play in carbon sequestration and associated impacts on climate regulation. Accordingly, the revised plan contains 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 (FW-DC-CARB 01), as well as a goal to collaboratively engage with Universities, Research Stations and other entities to improve upon existing knowledge and develop management approaches to address the effects of climate change (FW-GO-CARB 01). The revised plan also contains plan components that explicitly provide for ecosystem resiliency (FW-DC-WTR 01; RMZ 01; VEGF 02, 03, 04, 09; VEGNF 04; FIRE 01; CARB 01; WL 06; RECSUP

04; RNA 02), and includes standards and guidelines (FW-STD-GRAZ 01; FW-STD-TIM 08; FW-GDL-VEGF 01, 05) as proactive measures to improve ecosystem resilience relative to predicted changing climates. Collectively, these components in the revised plan would ensure that potential impacts of climate change are considerations for projects that could affect snowshoe hare and lynx habitat.

Second tier anthropogenic influences include those that research and management experience has shown to be less likely to have substantial effects to lynx and their habitat. Second tier factors include recreation, backcountry roads and trails, incidental trapping, illegal shooting, domestic livestock grazing and mineral and energy exploration and development (IBLT 2013).

Tier 2: Effects from Recreation

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. 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. 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).

The revised forest plan provides direction for the Forest Service, and does not regulate uses by the public (36 CFR 291.2(b)(2)). Any constraint on the public's use of NFS lands, not otherwise imposed by law or regulation, requires the Responsible Official to issue an order under 36 CFR part 261, Subpart B (Special Order) (FSH 1909.12 §21.8). Constraints on public recreational uses are imposed by laws such as the Wilderness Act of 1964, the Endangered Species Act of 1973, and the Montana Wilderness Study Act of 1977. These laws prohibit public motorized use in some areas, and prohibit the public from intentionally causing harm or "take" of species listed as threatened or endangered. Recreational use on NFS lands is affected by access management, which is regulated by Forest Travel Management Plans. The revised forest plan could indirectly affect public recreation through land use allocations, but where plan allocations change existing allowable uses, the revised plan must be followed up with a special order prohibiting otherwise legal public activities, or in the case where existing Travel Management Plans allow public uses that are inconsistent with the revised forest plan, the travel plan(s) must be amended or modified.

Forest plan allocations such as recommended wilderness areas, backcountry areas and key linkage areas could affect the types and levels of public recreation use, by limiting access and/or by limiting the types of recreation developments allowed. Recommended wilderness areas in the revised plan would not allow mechanized or motorized use by the public. No developed recreation sites (e.g. campgrounds, picnic areas, ski lifts, rental cabins, etc.) would be allowed in recommended wilderness areas. Backcountry areas would allow some motorized and/or mechanized use in some areas, but it varies by individual area. Most backcountry areas in the montane ecosystem, (where lynx may be present) are not suitable for motorized recreation under the revised plan. Key linkage areas would allow public recreational developments (roads, trails, etc.) to continue as currently authorized, but no new recreation developments would be allowed under the revised plan. Therefore, combined with existing

designated wilderness, these forest plan allocations would generally limit the type of recreational use to quiet, non-motorized activities over the majority of lynx habitat on the CGNF. Figure 2 and figure 3 and figure 4 show locations of forest plan allocations, and table 12 shows proportions of lynx habitat within designated wilderness and forest plan allocations.

The revised plan also includes land use allocations that would emphasize public recreation use. Recreation emphasis areas currently have, and are expected to continue to receive, relatively high levels of motorized and non-motorized recreation use, and may have a high density of recreation-related infrastructure relative to other parts of the Forest. These areas are typically located in reasonable proximity to human population centers with good access, and consequently, tend to be in areas already heavily used by the recreating public. 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. Five of the recreation emphasis areas in the revised plan are small relative to the scale at which lynx are likely to use the landscape; however the smaller acreage REAs tend to be linear and associated with water courses, therefore have potential to impede lynx movement. The remaining five REAs are larger, with the largest (Hebgen winter) overlapping one entire LAU and part of another.

Recreation emphasis areas are often adjacent to areas with land use restrictions such as designated wilderness, recommended wilderness backcountry area, or key linkage 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, which is consistent with direction adopted from the NRLMD to concentrate activities in existing developed areas, rather than developing new areas in lynx habitat (Objective HU O3). The revised plan includes a desired condition for recreation emphasis areas to provide sustainable recreation opportunities that are responsive to changing recreation demands (FW-DC-REA 01), and a guideline to reduce the likelihood of establishing unplanned visitor use patterns (FW-GDL-REA 01). Direction adopted from the NRLMD calls for new recreation developments to be designed to maintain effective lynx habitat and provide for lynx movement (Guideline HU G3). Collectively, this plan direction would serve to continue the concentration of human use and temper future impacts on surrounding lynx habitat from increasing recreation use.

Since lynx and snowshoe hares share an adaptation for deep, soft snow conditions, winter recreation effects have been studied. Direction adopted from the NRLMD seeks to maintain the lynx's natural competitive advantage over other predators in deep snow by discouraging the expansion of snow-compacting activities in lynx habitat (Objective HU O1). 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, snowshoeing and plowing roads) could impact lynx by lending a competitive advantage to other carnivores, such as coyotes (*Canis latrans*), bobcats (*Lynx rufus*) or mountain lions (*Puma concolor*), 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 (ILBT 2013). No comparable studies have occurred directly on the Custer Gallatin, but as part of the GYA, snow conditions (and associated lynx habitat) on the Custer Gallatin are more similar to those studied in northwestern Wyoming by Burghardt 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 identifies two 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 and Hebgen REAs. Winter recreation emphasis areas are expected to receive increasing levels of winter use, commensurate with human population growth and increasing popularity of the Greater Yellowstone Area for recreation opportunities. Such increased use could result in even larger areas of snow compaction as numbers of recreationists increase and technology evolves. However, these areas are currently managed, and heavily used for winter recreation with limited geographic opportunities for expansion, and plan components adopted from the NRLMD (Guideline HU G11) would limit new designated over-snow routes and designated play areas to the purpose of consolidating use to improve lynx habitat. The Hebgen Winter Recreation Area is the largest of all the REAs at nearly 71,000 acres, and is located in the MHG GA (secondary, occupied lynx habitat). Approximately 60 percent of the NFS lands in this REA are potential lynx habitat. Although the REA contains potential lynx habitat, it is partially located in an area dominated by obsidian sand soils, which are not conducive to growing spruce or subalpine fir trees. Much of the REA is dominated by lodgepole pine in the understory and overstory. As a result, part of the area within the Hebgen winter REA (east-southeast of Hebgen Lake) is not lynx habitat at all (not in an LAU), and other parts are potentially lower quality habitat for lynx and snowshoe hares, with lower presence of spruce and subalpine fir habitat.

The Hebgen winter REA is currently, and has been for many years, a popular winter recreation area with groomed snowmobile and ski trails, as well as large areas open to dispersed winter recreation. Consequently, this area is subject to high levels of noise disturbance and snow compaction associated with human uses. The REA is adjacent to Yellowstone National Park, where snowmobiling is allowed, but only on designated routes. The Lionhead BCA, Taylor Hilgard RWA, and Lee Metcalf Wilderness Area to the northwest of the Hebgen REA do not allow snowmobiles. Skiing and snowshoeing may occur in Wilderness, RWAs and BCAs, but trails generally would not be groomed in these areas. The other winter recreation emphasis area in the revised plan covers just over 24,000 acres in the Cooke City area, located in the AB GA (Core, occupied lynx habitat). Given the alpine nature of the area, only about 26 percent of this winter REA is potential lynx habitat. The Cooke City area has been a popular local and destination winter recreation for many years. The Cooke City winter recreation emphasis area is almost completely surrounded by the Absaroka-Beartooth Wilderness Area. Combined, the winter recreation emphasis areas cover about 95,000 acres, of which approximately 51 percent is potential lynx habitat. Winter recreation may impact lynx as described above, but emphasis areas can serve to consolidate such use, thereby potentially limiting impacts from dispersed winter recreation in surrounding lynx habitat, since many people might prefer the amenities associated with the recreation emphasis areas.

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 Forest, which may serve to consolidate winter recreation use, thereby limiting potential impacts to lynx from snow compacting activities that would otherwise be dispersed over larger areas. The revised plan includes 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 (FW-GDL-REA 01), which may discourage use for winter recreation. In addition, the Northern Rockies Lynx Management Direction contains guidelines that limit expansion of winter use areas and designated over-snow routes (NRLMD Guidelines HU G2, G3 and G11) 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, and additional plan allocations that restrict access and certain types of use outside of recreation emphasis areas, the revised plan provides 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. Table 16 shows proportions of potential lynx habitat within recreation emphasis areas.

Table 16. Potential lynx habitat within Recreation Emphasis Areas – NFS percent

Mapped Potential Lynx Habitat	Rec Emphasis Area Year Round	Rec Emphasis Area Winter	REA Total Acres Lynx Habitat
AB GA: Core	2%	1%	3%
MHG GA: Secondary	14%	10%	24%
Occupied Total	8%	6%	14%
BBC GA: Secondary	7%	0	7%
Pryors GA: Peripheral	0	0	0
Unoccupied Total	6%	0	6%
Lynx Habitat Total	8%	5%	13%

Olson and others (2018) studied the effects of developed and dispersed winter recreation on lynx in Colorado. They found that lynx reduced their rate of movement and became more nocturnal in areas with high levels of backcountry skiing and snowmobiling. Lynx in this study tended to avoid areas of intense motorized use, but used areas in close proximity to non-motorized trails. Highly developed ski resorts in Colorado were avoided by lynx, particularly during peak human use times. This study concluded that lynx did not show strong negative responses to dispersed recreation, but altered behavior patterns, indicating potential avoidance of recreationists. Lynx avoidance of developed recreation sites with high intensity of human use suggests there is some level of human disturbance that is not tolerated by lynx. There are two alpine (downhill) ski areas and three Nordic (cross-country) resorts that operate on the CGNF, all within potential lynx habitat; although one alpine area and one Nordic area are in unoccupied lynx areas. The revised plan contains a standard that new downhill ski areas would only be approved if existing permitted areas cannot accommodate additional use (FW-STD-RECSKI 01) and a guideline that would require emerging recreation uses such as zip lines, alpine slides and downhill mountain bike trails to be located at existing downhill ski areas if possible (FW-GDL-RECSKI 01). In addition, provisions are adopted from the NRLMD to provide for lynx habitat needs and connectivity in developed ski areas by retaining patches of lynx habitat between ski runs (Objective HU

O4, Guideline HU G1, G2). Again, the idea is that concentrating human recreation activities has less impact on wildlife, including lynx, than allowing additional development in relatively secure areas, consistent with NRLMD Objective HU O3.

The revised plan identifies a range of recreation experiences available on NFS lands, using a classification tool called the Recreation Opportunity Spectrum (ROS). The ROS is designed to provide Forest visitors with a variety of outdoor experiences and challenges. The CGNF revised plan classifies different areas into management categories defined by setting and the likely recreation experiences and activities afforded by each setting. The five ROS categories identified for the Custer Gallatin, from least developed to most developed include: primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, and rural. The ROS is consistent and highly correlated with land use designations and allocations in the revised plan. For example, all designated and recommended wilderness areas are in a primitive ROS classification. Backcountry areas in occupied and unoccupied lynx habitat are generally in a semi-primitive non-motorized classification, with semi-primitive motorized opportunities typically assigned to linear buffers around existing motorized routes (e.g. Buffalo Horn BCA). Recreation emphasis areas run the gamut for ROS from semi-primitive non-motorized in the upper section of the Hyalite REA, to semi-primitive motorized and roaded natural for most REAs. Linear REAs associated with road/river corridors (Gallatin Canyon, Yellowstone, Boulder and Rock Creek) are rural along paved sections of road, and roaded natural along unpaved portions. The revised plan includes separate plan components for each category of ROS (FW-DC/STD/GDL-ROS), which is also consistent and highly correlated with the land use designations and allocations. For example, no new motorized routes would be allowed in primitive ROS. Therefore, the effects on lynx from ROS direction in the revised plan were largely captured in the discussion of designated areas and forest plan allocations.

Tier 2: Effects from Roads and Trails

Public recreation on the Forest is often associated with infrastructure such as roads and trails, which provide recreation in the form of pleasure driving, sight-seeing, and walking or riding, but also provide access to off-route recreational opportunities. 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 direct mortality if a lynx attempting to cross is struck by a vehicle. However, lynx have been known to successfully cross highways (Interagency Lynx Biology Team 2013). National Forest System roads are categorized 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. Direction adopted from the NRLMD calls for mitigation to avoid or reduce impacts to lynx in rare instances where forest roads may be upgraded from Maintenance Level 4 to Maintenance Level 5 (Guideline HU G6). 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 all the Forest System roads on the Custer Gallatin, less than half (about 47 percent) are open to the public. The remainder are for administrative use only (not open for public use),

or currently out of service. 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 national forest system roads may have little direct effect on lynx as described above, the roads can have an indirect effect in providing access routes for human uses 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, yet some federally protected lynx have been incidentally caught in traps or illegally shot by hunters in Montana. However, none of these incidents have occurred on the Custer Gallatin National Forest (R. Inman, 2019. pers. comm.).

Under the revised plan, 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 (FW-DC-RT 01). To minimize impacts, the revised plan includes forestwide plan components that place restrictions on road construction and administrative facilities in old growth forest and riparian areas (FW-GDL-VEGF 02, FW-STD-RT 01, 05), encourage use of technologies that reduce impacts to other resources, and facilitate removal and restoration of roads and facilities no longer needed (FW-GDL-RT 01, 02). The emphasis on plan components for infrastructure management is to protect water and riparian resources, which are important habitat elements for lynx, as they can provide foraging and denning opportunities as well as important travel routes. Revised plan components provide more detailed guidance, and more restrictions on construction of new roads and other facilities, than currently contained in existing plans. In addition, the revised plan adopts components from the Northern Rockies Lynx Management Direction to avoid impacts to lynx associated with road upgrades, avoid locating new roads in important connecting areas for lynx, limit brush removal along forest roads, and limit use on project roads to administrative purposes (NRLMD Guidelines HU G6 – G9). Direction in the revised plan would limit habitat alterations due to new road construction in important lynx habitat, manage traffic volume and speed for lower levels to minimize disturbance and mortality risk, and limit use on project roads to administrative purposes over which the agency has more control. These collective plan components would minimize habitat impacts to lynx, while still providing management flexibility to maintain or restore lynx habitat where needed, as well as meet other multiple use mandates.

Tier 2: Effects from Domestic 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 includes desired conditions for livestock grazing allotments to maintain or trend toward desired ecological conditions stated for a variety of habitats (FW-DC-GRAZ 01), which include boreal forest types that could support lynx (NRLMD Objective GRAZ 01), as well as important intervening types that provide connectivity between patches of lynx habitat. To this end, the revised plan would require new or revised allotment management plans to incorporate grazing practices that avoid, minimize or mitigate adverse impacts to ecosystems (FW-STD-GRAZ 01, FW-GDL-GRAZ 03, 07, 08). 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. Plan components adopted from The Northern Rockies Lynx Management Direction provide a guideline (NRLMD Guideline GRAZ 01) to prevent such impacts. Currently, livestock grazing occurs in active grazing allotments on approximately 12 percent of the potential lynx habitat in occupied areas, and on just over 73 percent of the potential lynx habitat in unoccupied areas.

If not properly managed, livestock can have negative effects on vegetation due to overgrazing, trampling, and heavy browsing. The revised plan contains a number of plan components to manage livestock impacts in riparian habitats and deciduous woodlands such as aspen stands (FW-GDL-GRAZ 01, 02, 04, 05). These forest-wide plan components are complementary to direction adopted from the NRLMD guidelines (GRAZ G2, G3 and G4), which collectively, would serve to minimize livestock impacts in areas that function as important secondary habitat for lynx, and help maintain connectivity between patches of primary (boreal forest) habitat. Under the revised plan, vacant allotments may continue to be used for livestock production (e.g. be restocked or serve as grass banks), but they could also be permanently closed to address resource concerns (FW-GO-GRAZ 02). This forest plan goal could be used to the benefit of lynx if livestock use is shown to be having detrimental effects to lynx habitat.

Finally, the revised plan would prohibit stocking of grazing allotments with domestic sheep or goats for livestock production within occupied and unoccupied lynx habitat (FW-STD-GRAZ 02). There is little scientific information regarding potential dietary overlap with, or related forage competition between, domestic livestock and snowshoe hares (ILBT 2013). If forage competition with snowshoe hares were a significant factor, then the revised plan ban on domestic sheep and goat production in lynx habitat would eliminate at least part of that threat. On the other hand, the plan does allow for targeted use of domestic sheep and goats for weed control (FW-STD-GRAZ 03). Again, there is little scientific information regarding the impacts of noxious weeds on snowshoe hares or lynx. However, noxious weeds can have notable impacts on native vegetation, and targeted grazing by domestic sheep and goats has proven effective at reducing the spread of noxious weeds in some circumstances. The revised plan includes a number of measures to maintain tight control over domestic sheep or goats used for weed control (FW-STD-GRAZ 04).

Tier 2: Effects from Minerals and Energy Exploration and Development

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. Nationally, mining levels have dropped substantially from historic levels in lynx habitat, and modern mines operate under more stringent environmental protections than existed historically (ILBT 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.

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 includes desired conditions that energy and mineral resources are available for use (FW-DC-EMIN 01), but also includes 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 (FW-DC-EMIN 02, FW-STD-EMIN 01, 02). Plan components adopted from the Northern Rockies Lynx Management Direction include guidelines (NRLMD Guidelines HU G5, G12) to reclaim mined sites and minimize snow compaction related to mineral and energy management.

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. At the time this BA was prepared, the majority of locatable mineral operations active on the Custer Gallatin were located in the Stillwater complex in the AB GA. The Stillwater area has shown high potential for mineral development, specifically its unique platinum and palladium resources. As such, the Stillwater complex would receive land allocation under the revised plan as a mining emphasis area. The Stillwater complex is over 100,000 acres in size, of which about 45 percent is potential lynx habitat, and the remaining 55 percent of the area is non-lynx habitat (see figure 3 for location and configuration of the Stillwater Complex). The AB GA, and hence the Stillwater complex, are considered core, occupied lynx habitat. Lynx habitat in the Stillwater complex is roughly 11 percent of the potential lynx habitat in the entire AB GA, and about 5 percent of the potential lynx habitat in occupied lynx areas on the Forest. Mineral development would be expected to continue and perhaps expand, as a recognized value and use in the Stillwater mining complex area, with associated impacts to lynx habitat as described above. Plan components adopted from the NRLMD (noted above) would allow for mitigation measures to protect resources, including location of facilities and timing of use, to be imposed on any new proposals for minerals or energy development within the Stillwater complex.

Cumulative Effects

Cumulative effects under the Endangered Species Act include state, Tribal, local or private actions that are reasonably certain to occur within the action area for lynx. Approximately 450 square miles (287,878 acres) of state, county, city, and privately-owned lands fall within the boundaries of the Custer Gallatin National Forest in areas where lynx may be present. Non-federal ownership accounts for about 11 percent of all lands where lynx may be present within the CGNF boundary, including roughly 8 percent of occupied lynx areas and 29 percent of unoccupied areas. Non-federal lands contain both potential lynx habitat and non-lynx habitat at similar proportions to total land ownership. Ongoing and future human activities on these lands have the potential to adversely affect lynx and their habitats, through practices that reduce snowshoe hare habitat, create large-scale developments that result in permanent loss of lynx habitat and/or create barriers to lynx movement, or activities that result in human-caused mortality of lynx. Since the Forest Plan is a programmatic document that does not mandate, authorize or approve any site-specific projects or actions, it has no direct effects on lynx or

lynx habitat, but could have indirect effects as future projects and activities are planned, approved and implemented in compliance with the revised plan. Therefore, cumulative effects may result with ongoing and future actions allowed or implemented under land management plans for non-federal lands.

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. The Montana Department of Natural Resources and Conservation has a Habitat Conservation Plan (MTDNRC 2010) for management of forested state trust lands, and a Forest Action Plan (2017) that identifies priority actions and defines the role of state government in sustaining benefits from state and private forests. 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. The Forest Action Plan seeks to increase the amount of forest restoration on Federal lands through partnerships with government agencies and local communities, while promoting responsible, active forest management that ensures ecological conditions meet the needs of future generations for multiple resources, including wildlife habitat.

Human population growth is increasing at a dramatic rate in the Greater Yellowstone Area, including communities within and near the Custer Gallatin National Forest. Large-scale permanent developments to accommodate human population growth could occur on non-federal lands, with associated potential for adverse effects on lynx and their habitats. In 1999, Montana passed a “growth policy” statute (MCA 76-1-601 through 76-1-606) that established minimum requirements for growth policies. A growth policy is optional and non-regulatory. Montana State statutes allow, but do not require zoning. All seven Montana counties that overlap areas where lynx may be present on the CGNF (Madison, Gallatin, Park, Meagher, Sweet Grass, Stillwater and Carbon) have a growth policy in place. All but two (Meagher and Stillwater) specifically address wildlife habitat needs such as open space, movement corridors, and highway crossings. County growth policies are not regulatory and therefore would not preclude or restrict residential or commercial development on private lands in lynx habitat, but may impose mitigation measures through subdivision review and approval processes.

State-regulated hunting and trapping of wildlife can have adverse effects to individual lynx if they are illegally shot or trapped, or incidentally caught in traps set for other species. Since the lynx was listed as threatened, Montana Fish, Wildlife and Parks closed the fur trapping season for lynx, and revised trapping regulations to minimize the potential for lynx to get caught in traps set for other species. Any lynx that are unintentionally caught in traps set for other species must be immediately released if unharmed. Incidentally caught lynx must be reported to a Fish Wildlife and Parks warden or biologist within 24 hours of release if unharmed, and immediately if a lynx is found injured or dead in a trap set for another species (Montana FWP 2018).

Community Wildfire Protection Plans (CWPP) are collaborative agreements between local governments, fire departments, and State forest management agencies in consultation with Federal land management agencies and other interested parties. CWPPs identify and prioritize areas needing hazardous fuel

reduction on Federal and non-Federal lands to protect at-risk communities and essential infrastructure. CWPPs may assist State, local and private landowners by identifying areas in greatest need of fuel reduction treatment as well as recommending effective and efficient measures to reduce the chance that wildfire will ignite structures on their property (USDA 2004). CWPPs could encourage non-federal landowners to conduct fuel treatment projects in lynx habitat that may reduce snowshoe hare habitat, or otherwise temporarily or permanently alter lynx habitat. All seven Montana counties that include areas where lynx may be present on the CGNF have CWPPs in place.

Determination of Effect

Implementation of the proposed federal action ***may affect, and is likely to adversely affect Canada lynx*** on the Custer Gallatin National Forest.

Rationale for Determination

Coarse filter plan components to maintain habitats within a natural range of variation, combined with fine filter components adopted from the NRLMD to restrict certain management actions in lynx habitat, are expected to contribute to the conservation of Canada lynx.

However, the revised plan also supports a multiple use mandate, including vegetation management activities for resource purposes other than wildlife habitat restoration, maintenance or improvement. Allowable uses include timber harvest, prescribed burning, and other vegetation management actions that could reduce snowshoe hare habitat, which could have adverse impacts to lynx.

The revised plan does not determine the exact amount, location, type, or scope of future actions, but supports continued protection of human values at risk, including objectives for fuel reduction projects in the wildland urban interface. Exemptions to plan components adopted from the NRLMD for fuel reduction treatments in the wildland urban interface, and exceptions for vegetation management projects needed to address other resource issues, could result in temporary reductions in snowshoe hare habitat, which could affect foraging opportunities, with potential localized adverse effects for individual lynx in the vicinity of such treatments

In occupied lynx areas, invoking NRLMD exemptions to VEG S1, S2, S5 and S6 could result in up to 47,096 acres of snowshoe hare habitat treated (removed or reduced) over the life of the plan, with an additional 2,260 acres of snowshoe hare habitat treated using the exceptions to VEG S5 and S6.

In unoccupied lynx areas, there are currently no “exemptions” or “exceptions” to NRLMD direction, because the direction only applies to occupied lynx habitat. Assuming that treating six percent of lynx habitat for fuel treatment in WUI is a reasonable estimate for unoccupied lynx areas could result in 8,100 acres of snowshoe hare habitat treated in unoccupied lynx habitat, which could reduce foraging opportunities for lynx on the move. Since unoccupied areas are expected to receive only transitory use by lynx, temporary reductions in snowshoe hare habitat are expected to have insignificant effects for lynx moving through these areas.

Other uses that could occur under the revised plan, such as recreation, transportation, livestock grazing, and minerals and energy exploration and development, have the potential to adversely affect Canada lynx and their habitat in occupied areas through temporary or permanent habitat alterations, noise and disturbance, which could result in displacement of lynx.

Research is limited on many of these second tier potential risk factors, but recent research indicates that these factors are not likely to have substantial effects on lynx or their habitats (ILBT 2013), and collectively, impacts from recreation, transportation, livestock grazing and minerals/energy exploration and development are expected to have insignificant impacts to lynx in unoccupied areas.

Canada lynx designated critical habitat

Critical habitat was designated for Canada lynx in 2009 (USDI FWS 2009). In 2014, the FWS revised the 2009 designation of critical habitat and the distinct population boundary for the contiguous United States population of Canada lynx to include all or portions of ten National Forests (including both the Custer and Gallatin) that appended the NRLMD to their land and resource management plans (forest plans) in 2007 (USDI FWS 2014).

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, and which may require special management considerations or protections. 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 2014).

Designated critical habitat in the action area

The Custer Gallatin is within the GYA, or Unit 5 of designated critical habitat for lynx. Unit 5 consists of 9,146 mi² (roughly 5,853,440 acres) of land in the Greater Yellowstone area of southwestern Montana and northwestern Wyoming (USDI FWS 2014). Approximately 1,434,687 acres of designated critical habitat for lynx, or nearly 25 percent of the total designated critical habitat in Unit 5, falls within the boundary of the Custer Gallatin National Forest; of that, roughly 1,363,814 acres (95%) is on NFS lands. Critical habitat is designated in those portions of the Custer Gallatin with the highest potential to support residential lynx use over time, which is located in the AB and MHG GAs. Therefore, the AB and MHG GAs combined were used as the analysis area for designated critical habitat for Canada lynx.

Environmental Baseline

Designated critical habitat for lynx covers roughly 61 percent of the area within the AB and MHG GAs. Areas with potential lynx habitat outside of designated critical habitat contain conditions that may support transient use by lynx, but the capacity to support residential lynx is unknown, as these areas may not provide adequate quantities or combinations of habitat elements essential for meeting all life cycle needs of the lynx (USDI FWS 2014).

As with lynx habitat, critical habitat primary constituent elements 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 the life of the forest plan. Quantities of snowshoe hare habitat and denning habitat (primary constituent elements (a) and (c)) are estimates as of the time this analysis was prepared. Primary constituent element (a), winter snowshoe hare habitat, was described previously 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, including both the younger, stand-initiation stage as well as the multi-storied mature stage of lynx habitat.

Element (b), winter snow condition, is less well-defined and more 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 GAs of the Custer Gallatin.

Lynx have a competitive advantage over more generalist predators in deep, soft snow, a condition which as noted above is difficult to quantify. However, Copeland and associates (2010) examined a number of factors to predict where winter snow accumulation persists well into the spring. Although snow conditions on the Forest are not always deep, soft, or fluffy, areas of persistent snowpack (per Copeland et al. 2010) were used as a proxy to quantify where PCE 1b is most likely to occur on the Forest. This modeling effort indicates that roughly 73 percent of designated lynx critical habitat on the Forest occurs in areas of persistent snow cover. This figure includes all primary constituent elements of designated critical habitat for lynx, including both the boreal forest lynx habitat as well as matrix habitat, since deep snow can benefit lynx and snowshoe hares wherever it occurs. Only about 36 percent of the modeled persistent snowpack in critical habitat overlaps the boreal forest types most likely to be used by lynx; the other 64 percent of modeled persistent snowpack overlaps with the matrix element of critical habitat. This configuration is at least partly due to large alpine areas that have persistent snowpack due to high elevation, but do not provide lynx denning or foraging habitat. Another way to look at this is that approximately 61 percent of the boreal forest types in designated critical habitat are within the modeled persistent snowpack, whereas about 83 percent of the matrix habitat is within modeled persistent snowpack.

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 fluctuation (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 (ILBT 2013).

Element (c), denning habitat, was described previously for lynx habitat in general. No lynx dens have been documented on the Custer Gallatin. However, 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. Based on historic fire regimes and recent natural disturbance patterns, roughly 38 percent of the Forest in designated critical habitat is 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, it is likely available in reasonable proximity to much of the suitable foraging habitat. For these reasons, denning habitat for lynx is not currently a limiting factor on the Forest. Given the nature and frequency of disturbance events in the montane ecosystem of the Custer Gallatin, denning habitat is expected 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 (boreal) forest conditions most important to lynx and snowshoe hares. Matrix 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 high quality 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 the Forest falls into the matrix category. Table 17 summarizes the amount and proportion of designated critical habitat for lynx within the Forest.

Table 17. Designated Critical Habitat for Lynx - Primary Constituent Elements – NFS Acres

Critical Habitat	PCE 1a Snowshoe hare habitat ¹	PCE 1b Persistent Snow ²	PCE 1c Denning Habitat ³	PCE 1d Matrix ⁴	Total Acres Designated Critical Habitat
AB	139,867 13%	812,839 78%	321,435 31%	665,347 64%	1,040,829
MHG	112,010 35%	186,579 58%	197,266 61%	108,022 33%	322,985
Totals	251,877 18%	999,418 73%	518,701 38%	773,369 57%	1,363,814

¹Includes stand initiation stage and multi-storied; percent is of total designated critical habitat

²From Copeland et al. 2010: modeled persistent snow cover for wolverines; % of total DCH

³Includes multi-storied and other mature lynx habitat; % of total DCH

⁴Includes non-lynx habitat within designated critical habitat; % of total DCH

Factors affecting designated critical habitat for Canada lynx

In its final rule designating critical habitat (USDI FWS 2014), the Service identified the following federal actions that would potentially adversely modify critical habitat:

1. Actions that would reduce or remove understory vegetation within boreal forest stands on a scale proportionate to the large landscape used by lynx. These activities could significantly reduce the quality of snowshoe hare habitat such that the landscape’s ability to produce adequate densities of snowshoe hares to support persistent lynx populations is at least temporarily diminished.
2. Actions that would cause permanent loss or conversion of the boreal forest on a scale proportionate to the large landscape used by lynx. Such activities could eliminate and fragment lynx and snowshoe hare habitat.
3. Actions that would increase traffic volume and speed on roads that divide lynx critical habitat. These activities could reduce connectivity within the boreal landscape for lynx and could result in increased mortality of lynx.

Effects of the proposed action on factors affecting designated critical habitat for Canada lynx in the action area

Direction in the revised plan, including plan components adopted from the NRLMD, focus on habitat management. As such, there is considerable overlap between effects analysis for lynx with analysis for designated critical habitat, and parts of each analysis are applicable to the other. The proposed action provides programmatic direction, and does not propose, authorize, approve, or mandate any site-specific actions that may occur in the future. Therefore, the proposed action would have no direct effect on designated critical habitat for lynx. However, ongoing and future land uses and management proposals would be required to follow programmatic direction contained in the plan, and thus, the proposed action would indirectly affect designated critical habitat for Canada lynx. In 2017, the Forest Service initiated formal consultation to address the effects of implementing the NRLMD on designated critical lynx habitat in the Northern Rockies (Conway and Hanvey 2017), which included critical habitat on the CGNF. That analysis will not be repeated here, but may be incorporated by reference. This BA will address the collective effects of the revised Custer Gallatin plan, including those plan components adopted from the NRLMD, on critical lynx habitat within the Custer Gallatin National Forest. Table 18 lists specific plan components, including those adopted from the NRLMD that could affect the various primary constituent elements of designated critical habitat for lynx.

Table 18. Plan Components and NRLMD Components Relevant to PCEs in Designated Critical Habitat

Primary Constituent Element	Primary Constituent Element Description	Revised Custer Gallatin Plan Components	Associated NRLMD Direction
1.	Boreal forest landscapes supporting a mosaic of differing successional forest stages and containing:	FW-DC-VEGF 01, 03, 04, 06 FW-DC-FIRE 01 FW-OBJ-FIRE 01, 02 FW-GDL-FIRE 01, 03 FW-DC-WL 02, 03, 04 FW-DC-WLLX 01; STD 01	VEG O1, VEG O2, VEG O3, VEG O4
a	Presence of snowshoe hares and their preferred	FW-DC-VEGF 03, 07, 09 FW-GDL-VEGF 01, 02	VEG S1, VEG S2, VEG S5, VEG S6

	habitat; includes both stand initiation stage and multi-story mature	FW-DC-FIRE 01, 02 FW-OBJ-FIRE 01, 02 FW-GDL-FIRE 01, 02, 03 FW-STD-WLLX 02 FW-STD-TIM 04, 08, 11 FW-GDL-TIM 01 FW-STD-RECRES 01 FW-STD-RECSKI 01 FW-GDL-RECSKI 01	VEG G1, VEG G4, VEG G10, GRAZ G1, GRAZ G2, GRAZ G3 HU G1, HU G2, HU G5, HU G8
b	Winter snow conditions that are generally deep and fluffy for extended periods of time;	FW-DC-CARB 01 FW-SUIT-ROSSPNM 01 FW-DC-WL 04 FW-STD-EMIN 02 FW-DC-RECDEV 09 FW-STD/GDL-RECSKI 01 FW-GDL-REA 01	VEG G4, HU G4, HU G11, HU G12
c	Sites for denning that have abundant coarse woody debris, such as downed trees and root wads; and	FW-DC-SOIL 03; GDL 07 FW-DC-VEGF 05, 07, 08, 09 FW-GDL-VEGF 01-05 FW-DC-FIRE 01, 02 FW-OBJ-FIRE 01, 02 FW-STD-TIM 04, 08 FW-GDL-TIM 01, 02 FW-DC-RECDEV 02, 06 FW-STD/GDL-RECSKI 01	VEG G5, VEG G11, HU G1
d	Matrix habitat (e.g. hardwood forest, dry forest, non-forest or other habitat types that do not support snowshoe hares) that occurs between patches of boreal forest	FW-DC-WTR 02, 04, 06, 10 FW-DC-RMZ (most) FW-DC-VEGF 02-09 FW-DC-VEGNF 04 FW-DC-FIRE 01 FW-OBJ-FIRE 01, 02 FW-DC-WL 05, 06, 07 FW-GO-WL 02, 03, 05 FW-GDL-WL 01-05 FW-GDL-WLBG 01 FW-DC-WLLX 01 FW-GO-RT 03; GDL-RT 02 FW-DC-RECDEV 06 FW-STD/GDL-RECSKI 01 FW-DC-LAND 01	ALL S1, All G1 LINK S1, LINK G1, LINK G2

The primary factors with potential to adversely affect designated critical habitat are those that reduce understory vegetation, result in permanent habitat loss, or result in increased traffic speed/volume. In matrix habitat, these factors would only have adverse effects if they produce a barrier, or impede lynx movement between patches of boreal forest (USDI FWS 2014). These factors relative to management practices regulated by the revised plan, would be tempered by large portions of the action area with

land use designations and/or forest plan allocations that restrict activities that could result in the above listed adverse effects. A considerable proportion (55%) of designated critical habitat for lynx on the CGNF is currently within designated wilderness, where mechanical vegetation management, most permanent development, and roads are prohibited. An additional 28 percent is similarly protected within a wilderness study area, inventoried roadless areas, and recommended wilderness, for a total of 83% of designated critical habitat within protected areas where management practices are unlikely to result in adverse effects.

Under the revised plan, the amount of designated wilderness would not change, but additional land use allocations would be implemented, such as additional recommended wilderness, backcountry areas, and key linkage areas that would provide similar, and in some cases additional restrictions on management actions that could have adverse effects on designated critical habitat for lynx. Many of the land use allocations in the revised plan overlap spatially with the existing wilderness study area and/or inventoried roadless areas, but collectively would maintain approximately 84% of the designated critical habitat for lynx in areas with land use restrictions that minimize potential for adverse effects. A more detailed description of land use restrictions in designated areas and forest plan allocations was provided above in the effects analysis for lynx. The greater proportion of the matrix element (PCE 1d) within protected areas relative to the lynx habitat elements (PCE 1a, c), is commensurate with the overall makeup of critical habitat. However, under the revised plan, additional protections afforded by land use allocations would increase protections for lynx habitat more than for matrix elements. Table 19 breaks out the proportions of lynx critical habitat that would be within the various protected areas.

Table 19. Percent of Designated Critical Lynx Habitat within Land Use Designations and Forest Plan Allocations – NFS Ownership

Designation Allocation	Existing Plans				Revised Plan			
	Lynx Hab ¹	Matrix ²	Persist Snow ³	Total ⁴	Lynx Hab ¹	Matrix ²	Persist Snow ³	Total ⁴
Designated Wilderness	39	67	66	55	39	67	66	55
Wilderness Study Area	13	8	10	10	2	2	3	2
Inventoried Roadless	21	14	13	17	20	13	12	16
Recommended Wilderness	1	< 1	< 1	1	8	5	7	7
Backcountry Area	0	0	0	0	5	2	2	3
Key Linkage Area	0	0	0	0	2	1	< 1	1
Total Designations	74	89	89	83	76	90	90	84

¹Proportion (%) of Total Lynx Habitat in CH; ²Proportion of Total Matrix; ³Proportion of Total Persistent Snow Cover; ⁴Proportion of Total Critical Habitat

PCE 1 – Boreal forest landscapes supporting a mosaic of successional forest stages

Fire and other natural disturbance processes historically played an important role in maintaining a mosaic of forest successional stages that provides habitat for both lynx and their primary prey, snowshoe hares (Ruediger et al. 2000), and by association, provide the primary constituent element of designated critical habitat. As noted above for effects to lynx, natural processes are expected to be the primary agent driving lynx habitat conditions, with management actions having a relatively small effect. The revised plan takes a more ecological approach than existing plans, by placing strong emphasis on maintaining or restoring ecological integrity, in part by managing for vegetative conditions that are within the natural (historic) range of conditions to which native species have adapted over time. As with

lynx habitat overall, the expected trajectory for lynx critical habitat over the life of the revised plan, is that the amount of stand initiation stage snowshoe hare habitat (PCE 1a) would increase relative to early stand initiation stage. Likewise, the amount of multi-storied snowshoe hare habitat (PCE 1a) is predicted to increase relative to other mature habitat over the first two decades (which is the estimated life of the plan; e.g. 10-15 years), but that trend could reverse after the first two decades (assuming the plan is still in place for over 20 years), due to natural succession and subsequent maturing of young stands into a young-mature stage, where tree growth and self-pruning are expected to reduce the amount of horizontal cover for hares. Figure 8 in the lynx effects analysis above shows the expected trajectory for lynx habitat components over time. This figure roughly characterizes what would be expected in designated critical habitat as well.

The revised plan contains desired conditions for forested habitat within the natural range of variation for tree species dominance type, successional stage, forest density and landscape patch size (FW-DC-VEGF 01, 03, 04 and 06), which are the factors that largely drive habitat availability and quality for lynx and snowshoe hares. Managing to maintain or restore these conditions within the natural range at a landscape scale would provide a mosaic of differing successional stages in cool, moist forest types preferred by lynx over the life of the plan. Desired conditions for fire are that the amount and severity of wildland fire is within the natural range of variation to maintain resilient ecological conditions (FW-DC-FIRE 01), which would be partially achieved through a guideline to use wildland fires across the forest to meet multiple resource needs (FW-GDL-FIRE 01). The potential for individual wildland fires to have beneficial, neutral, or adverse effects on snowshoe hare habitat suitability, lynx population dynamics, and the lynx habitat PCE depends on the local habitat conditions combined with when and where fires occur. However, fire has historically been the predominant driver of lynx habitat conditions in the Greater Yellowstone Area, and a management paradigm to reflect natural patterns is expected to be the best strategy for managing lynx habitat.

In the Greater Yellowstone Area (Unit 5, designated critical habitat for lynx), fire regimes are variable, with both frequent (35-100 years) stand-replacing or mixed severity fires, mainly in stands dominated by lodgepole pine, and infrequent (200+ years) stand replacement fires, typical in stands dominated by spruce and subalpine fir. Intentional suppression of wildfires and related fire exclusion has the potential to affect vegetation mosaics by altering structural characteristics and tree species dominance type, which could affect habitat quality for snowshoe hares and lynx (ILBT 2013). In western forests, fire suppression efforts resulting in fire exclusion have likely had much more notable impact in areas with a history of frequent fire return intervals than in areas with infrequent fire intervals (Ruediger et al. 2000). The revised plan desired condition to allow wildfires to burn within the natural range of variation (FW-DC-FIRE 01) and guideline to use wildland fire to achieve resource benefits (FW-GDL-FIRE 01) would support increased amounts of fire within lynx critical habitat to create mosaic conditions favoring the lynx's life cycle needs. In addition, a guideline to use minimum impact suppression tactics to minimize resource damage (FW-GDL-FIRE 03) could help protect known areas of high quality snowshoe hare habitat, denning habitat and/or travel routes from unintended impacts of fire suppression.

The revised plan contains desired conditions for wildlife habitat within the natural range of variation to provide for a variety of life cycle needs, as well as secure areas that provide refuge for wildlife to escape from stresses, while still meeting basic needs such as feeding, breeding, sheltering and movement (FW-DC-WL 03, 04). The revised plan also contains desired conditions for habitat that contributes to species recovery needs, and lands within critical habitats designated by the U.S. Fish and Wildlife Service

provide the physical and biological features identified as essential to the conservation and recovery of listed species (FW-DC-WL 02), with a specific desired condition for boreal forest habitats that provide denning, foraging, resting and travel opportunities for Canada lynx (FW-DC-WLLX 01). In addition, the revised plan would require continued application of the Northern Rockies Lynx Management Direction (FW-STD-WLLX 01) and would also limit use of NRLMD exemptions to ensure that fuel treatments do not disproportionately affect designated critical habitat (FW-STD-WLLX 02). Collectively, these plan components are complimentary to, and would contribute toward maintaining PCE 1, and achieving objectives in the NRLMD to manage vegetation to approximate natural succession and disturbance processes, provide a mosaic of habitat conditions, and use fire to restore ecological processes (NRLMD Objectives VEG O1, O2, and O3). All future projects in designated critical habitat for lynx would have to address how they contribute toward desired conditions, or at least show they would not preclude achievement of desired conditions.

PCE 1a. Snowshoe Hare Habitat

Desired conditions for tree size (FW-DC-VEGF 03) would promote management actions to maintain the proportion of small tree size classes (0 to 9.9" dbh) at between 10 to 65 percent of the cool, moist forest types. These size classes are the most likely to provide the stand initiation stage habitat with high stem densities that provide high quality snowshoe hare habitat, and the plan components for maintaining tree size classes would contribute to the presence of advanced regeneration snowshoe hare habitat over time. This same plan component would promote management actions to maintain the proportion of medium to large trees (≥ 10 dbh), at between 45 to 85 percent of the cool, moist forest types. These size classes are the most likely to provide the mature, multi-storied structural stage snowshoe hare habitat, although some of the smaller size classes are capable of achieving multiple stories as well.

The revised plan also contains desired conditions for forested habitats that the extent, concentration and distribution of large (≥ 15 " dbh) live tree structure is sufficient to provide structural diversity, wildlife habitat, and potential late-seral forest conditions (FW-DC-VEGF 07), and for the amount of old growth forest to be maintained or increased over the existing (2019) condition (FW-DC-VEGF 09). The presence of individual large trees contributes structure conducive to creating multi-storied snowshoe hare habitat by providing seed source, spacing, and eventual gaps with turnover, that facilitate production of dense understory growth selected by snowshoe hares. Larger trees also tend to have the large, low branches that reach the snow surface, providing food and cover for snowshoe hares in winter. Old growth is not the only forest structure that produces multi-story snowshoe hare habitat, but has many characteristics conducive to producing multiple canopy layers and dense understory important for snowshoe hares, such as mature trees for seed source, large trees with low branches, and large gaps in the forest canopy that allow light penetration to the ground and subsequent stimulation of understory growth. Old growth forest is also less likely than younger forest to exhibit self-pruning measures that reduce horizontal cover for hares. The revised plan contains guidelines that limit management treatments that would alter old growth characteristics (FW-GDL-VEGF 01, 02). Collectively, these plan components would contribute to the availability of multi-storied mature snowshoe hare habitat over the life of the plan.

The revised plan includes desired conditions for the amount and severity of wildfire to be within the natural range of variation (FW-DC-FIRE 01). Stand-replacing fire is the primary disturbance factor that sets forest habitat back to an early successional stage that typically does not provide suitable habitat for snowshoe hares or lynx in the short term. However, this same driver begins the natural forest

succession process that eventually produces stand initiation stage snowshoe hare habitat. Since wildland fire often burns with varying intensity, it has the potential to create stand initiation stage snowshoe hare habitat in a mosaic with older, mature forest stands that may provide multi-story snowshoe hare habitat, denning sites, and/or travel routes that can be easier for lynx to hunt in than the dense young stands often preferred by hares (Holbrook et al. 2018). A forest plan guideline to use wildland fires for resource benefits (FW-GDL-FIRE 01) would promote management actions that result in habitat diversity important to lynx and snowshoe hares.

While the revised plan would support natural fire regimes at the landscape scale, it also contains a desired condition that vegetation conditions within the wildland urban interface and adjacent to infrastructure support only low-intensity fire to minimize impacts to human values at risk (FW-DC-FIRE 02). Guidelines to achieve this condition call for fuel treatments designed to remove or rearrange the live and dead vegetation as necessary to reduce fire intensity (FW-GDL-FIRE 02). Plan components designed to protect values at risk (typically found within the wildland urban interface), have the potential to reduce snowshoe hare habitat, which could in turn have adverse effects on lynx by reducing foraging opportunities. Such impacts would be localized and limited to individual lynx, since fuel reduction projects in the wildland urban interface would rarely reach or exceed the scale proportionate to the large landscape used by lynx. Plan components adopted from the NRLMD would limit the amount of early successional stage lynx habitat created by prescribed fire (Standard VEG S1), and would also limit the amount of fuel reduction treatment that could reduce snowshoe hare habitat in WUI to no more than 6 percent cumulatively (i.e. prescribed fire combined with timber harvest) of the lynx habitat (i.e. not counting the matrix element) on the Forest (Standards VEG S2, S5 and S6).

To ensure that fuel treatment allowed in the WUI does not disproportionately affect designated critical habitat, the revised plan adds a standard that vegetation management for fuel reduction in the WUI that reduces snowshoe hare habitat shall occur on no more than 6 percent cumulatively of the lynx habitat (excluding matrix element) in designated critical habitat for lynx (FW-STD-WLLX 02). Based on the most current lynx habitat mapping for the Custer Gallatin (updated for plan revision), there are approximately 590,445 acres of lynx habitat (not matrix) in designated critical habitat. Therefore, the revised plan would allow for roughly 35,426 acres of fuel treatment projects in the wildland urban interface that could reduce snowshoe hare habitat in designated critical habitat over the life of the plan. This type of treatment would be distributed over a half-million acres of potential lynx habitat within designated critical habitat on the Forest, and therefore, would not be expected to reach or exceed the scale proportionate to the large landscape used by lynx with any single project.

To date, the Forest has implemented only 990 acres of fuel treatment in designated critical habitat using the NRLMD exemptions for fuel treatment in WUI. This treatment amounts to just over 2 percent of the total allowed, and has affected only about one-tenth of one percent of the potential lynx habitat in designated critical habitat for lynx on the CGNF. Revised plan objectives call for a minimum of 6,000 acres of hazardous fuels treatment per year over the life of the plan (FW-OBJ-FIRE 01). Not all fuel reduction projects would occur in designated critical habitat, or in potential lynx habitat, and not all of those that could occur in potential lynx habitat would require use of the exemptions for treating snowshoe hare habitat. Based on revised plan objectives, it is reasonable to assume that fuel treatment projects in designated critical habitat for lynx using the NRLMD exemptions would be accelerated relative to projects implemented under existing plans. However, new plan component FW-STD-WLLX 02 combined with standards adopted from the NRLMD (Standards VEG S5 and VEG S6) would prohibit

management actions from exceeding the remaining 34,436 acres of snowshoe hare habitat treatment allowed in the total exemptions provided in designated critical lynx habitat over the life of the plan.

Timber management through mechanical harvest can have negative impacts on existing snowshoe hare habitat, but can also be used create or maintain the diversity in forest structural stages important to lynx over time (Zimmer et al. 2008, Holbrook et al. 2019). Timber harvest in lynx habitat that reduces high horizontal cover in the understory, or reduces stem density in stand initiation stage forest, would reduce potential snowshoe hare habitat, with possible adverse effects on lynx due to impacts on foraging opportunities. Plan components adopted from the NRLMD (Standards VEG S5 and S6) would prohibit timber harvest that reduces existing snowshoe hare habitat except for purposes of reducing hazardous fuels in WUI. The NRLMD contains exemptions for these standards that would allow timber harvest that reduces snowshoe hare habitat for fuel treatment in WUI, but combined with revised plan standard (FW-STD-WLLX 02) would limit the associated impacts to no more than 6 percent cumulatively (combined with prescribed burning) of the total potential lynx habitat within designated critical habitat for lynx on the Forest over the life of the plan, as described above for fuel reduction projects.

The revised plan contains standards (FW-STD-TIM 04, 08) that require other resource considerations and maximum harvest unit sizes for projects involving clear-cuts or other regeneration harvest methods. Plan components adopted from the NRLMD (Standard VEG S1 and S2), limit the amount of regeneration timber harvest that can contribute to early stand initiation stage lynx habitat. Standard VEG S1 sets the maximum amount of potential lynx habitat (and thus critical habitat where it occurs within potential lynx habitat) that can be in an early stand initiation structural stage that does not yet provide winter snowshoe hare habitat to 30 percent of the lynx habitat within an individual Lynx Analysis Unit (LAU). Once an LAU reaches a stage where 30 percent (or more) of the potential lynx habitat is in an early stand initiation stage due to natural processes and/or management actions, no further management actions would be allowed to convert lynx habitat to an early stand initiation stage. NRLMD Standard VEG S2 limits the amount of early stand initiation stage lynx habitat that can be created through timber harvest to no more than 15 percent of the potential lynx habitat within any single LAU in a ten year period. The NRLMD contains exemptions for standards VEG S1 and S2 for purposes of fuel reduction in the WUI, subject to the 6 percent limit for lynx habitat affected as described above. Exemptions applied for fuel treatments in WUI could adversely affect PCE 1a should they occur within designated critical habitat for lynx. Collectively, revised plan components would limit the overall amount, and patch size, of lynx habitat that could mechanically (through timber harvest) be converted to a condition that, at least temporarily, would not provide suitable habitat for snowshoe hares, while allowing for some treatment that would contribute to future snowshoe hare habitat, and maintain structural diversity for lynx. The revised plan also contains a guideline (FW-GDL-TIM 01) that salvage harvest in areas burned by wildfire should retain some patches of trees that survived the fire to provide habitat for wildlife, which would help maintain suitable hare habitat that survives wildland fire.

Finally, the revised plan contains a standard (FW-STD-TIM 10) that would require reasonable assurance of restocking (conifer regeneration) within 5 years after harvest. This standard would ensure that timber harvest within potential lynx habitat is conducted in a way that facilitates natural progression back to stand initiation stage lynx habitat within a reasonable timeframe. Domestic livestock and wild herbivores may be attracted to a flush of new herbaceous vegetation after recent harvest or other disturbance, and ungulate grazing in recently disturbed areas can delay regeneration of conifers, and also hinder growth of deciduous trees and shrubs such as aspen or willow that can provide snowshoe

hare forage and cover in early successional stage forest. Plan components adopted from the NRLMD (Guidelines GRAZ G1, G2, G3) require livestock management techniques that would limit impacts to developing trees and shrubs in harvest units and burn areas, which would minimize potential impacts from livestock grazing in PCE 1a.

Permanent habitat alterations due to human developments can result in a loss of potential lynx habitat within designated critical habitat. Permanent developments on NFS lands that have the potential to affect designated critical lynx habitat on a scale proportionate to the large landscapes used by lynx, would generally be associated with large developed recreation areas, such as ski areas, etc. Such permanent developments could remove existing snowshoe hare habitat, as well as reduce potential future snowshoe hare habitat, with corresponding adverse effects on PCE 1a, should these types of conversions occur in designated critical habitat for lynx. Under the revised plan, a large proportion (76%) of the potential lynx habitat within designated critical habitat would be within protective designations and forest plan allocations (table 19) that would not permit large new permanent developments. In addition to restrictions associated with land use designations and allocations, the revised plan would not allow new recreation residence developments anywhere in designated critical habitat (FW-STD-RECRES 01). The revised plan would allow new downhill ski areas only if existing ski areas could not be expanded to accommodate additional use (FW-STD-RECSKI 01), and new types of recreation such as zip lines, alpine slides and downhill mountain bike trails would be located within the footprint of existing downhill ski areas unless such use could not be accommodated (FW-GDL-RECSKI 01). Plan components adopted from the NRLMD (Guidelines HU G1, G2 and G3) would further require some lynx and snowshoe hare habitat to be maintained if existing ski areas are expanded or further developed. Collectively, these plan components would not preclude any possible future effects, but would serve to minimize and concentrate the amount of permanent habitat conversion that would be allowed to impact existing or potential future snowshoe hare habitat.

PCE 1b. Winter snow conditions that are deep, soft and persist for extended periods of time

Forest management typically does not influence winter snow conditions proportionate to the scale of large landscapes used by lynx, as snow conditions at large scales are more a function of geology and climate. However, the revised plan recognizes the role of coniferous forests relative to climate, and accordingly includes a desired condition that carbon storage and sequestration potential is sustained by biologically diverse and resilient forests, woodlands, and shrublands that are adapted to natural disturbance processes and changing climates (FW-DC-CARB 01). Managing vegetation to achieve this desired condition would support lynx and snowshoe hare habitat, and contribute toward forest resilience, which in turn may help to maintain persistent snow conditions, although most likely in a very minor way compared to natural processes that are being affected at a global scale.

Management actions can result in snow compaction in localized areas, typically associated with designated winter recreation use areas. Human-caused snow compaction may facilitate and thereby increase use of lynx habitat by predators competing with lynx for the same prey base, or could also increase the potential lynx mortality due to predation by larger predators such as mountain lions or wolves (*Canis lupus*). The persistent snow element (PCE 1b) covers both lynx habitat elements and matrix habitat. Under the revised plan, roughly 66 percent of the persistent snow element within designated critical habitat on the CGNF would remain within designated wilderness, with an additional 7 percent in recommended wilderness. Therefore, snow compaction due to human uses would be negligent in 73 percent of the persistent snow element. Motorized over snow use is allowed in all or

some portions of the other designated areas and forest plan allocations, and restricted in others. Outside of designated and recommended wilderness areas, nearly 11 percent of the persistent snow element would remain protected by forest plan allocations, coupled with travel management restrictions that prohibit motorized over snow use. These areas are within the semi-primitive, non-motorized winter Recreation Opportunity Spectrum class (FW-SUIT-ROSSPNM 01). In sum, about 84 percent of the persistent snow element of designated critical habitat would be within a management designation or allocation that would not allow motorized over snow use, which would considerably limit impacts to PCE 1b due to snow compaction associated with human use.

Outside of designated areas and forest plan allocations with restrictions on over snow use, human caused snow compaction could occur in critical lynx habitat, primarily associated with recreation use at developed ski areas and popular snowmobile use areas. Cross country skiing and snowshoeing would add to snow compaction, but on a very minor level, since people simply can't cover as much ground as quickly with non-motorized means as they can with motorized vehicles. Of the five ski areas (two alpine and three Nordic) operating on the CGNF, only one, Red Lodge Mountain Resort (alpine area) is within designated critical habitat for lynx. Roughly 2,300 acres of the special use permit area for Red Lodge Mountain is within designated critical habitat. The revised plan would allow new downhill (alpine) ski areas only if existing ski areas could not be expanded to accommodate additional use (FW-STD-RECSKI 01), and would locate new downhill recreation uses within existing permitted areas (FW-GDL-RECSKI 01). New Nordic ski areas could be considered under the revised plan, but the NRLMD (Guideline HU G3) would require that any such development and associated operations be designed to provide for lynx movement and to maintain the effectiveness of lynx habitat.

Travel Management Plans were completed before the Custer and Gallatin Forests were formally combined in 2014, and neither Forest designated winter play areas in the respective travel plans. Under the revised forest plan, a new land use allocation of recreation emphasis area was added to acknowledge and foster concentrated recreation use in highly popular areas already receiving high levels of recreation use. Forest plan allocations of recreation emphasis areas would not result in changes to existing travel management plans that would affect the types of use allowed, but rather provide an emphasis for how these areas are managed. Recreation emphasis areas are expected to receive increasing levels of winter use commensurate with human population growth and increasing popularity of the Greater Yellowstone Area for recreation opportunities. Such increased use could result in additional snow compaction as numbers of recreationists increase and technology evolves. However, winter recreation emphasis areas are currently managed and heavily used for winter recreation, with limited geographic opportunities for expansion. In addition, plan components adopted from the NRLMD (Guideline HU G11) would limit new designated over-snow routes and designated play areas within recreation emphasis areas, to be allowed only for the purpose of consolidating recreation use in order to improve lynx habitat.

Inside designated critical habitat for lynx, there is one recreation emphasis area specifically identified for winter use, which covers just over 24,000 acres near Cooke City in the Absaroka-Beartooth Geographic Area. Due to the high elevation, alpine nature of this area, not all of the Cooke City winter REA is within designated critical habitat for lynx; roughly 13,700 acres of the REA are within the persistent snow element of critical habitat. Snow compaction associated with winter recreation in the portion of the Cooke City REA within critical habitat would affect just over 1 percent of the total persistent snow element (PCE 1b) on the Forest. The Cooke City area has been a popular local and destination winter

recreation site for many years. The Cooke City winter recreation emphasis area is almost completely surrounded by the Absaroka-Beartooth Wilderness Area, leaving little room for increased snow compaction due to human uses. Even as numbers of recreationists increase and technology evolves, the area of snow compaction is not expected to increase significantly because the REA is already quite saturated with use, and wilderness area boundaries are regularly patrolled for illegal motorized incursions.

Other (year round) recreation emphasis areas may also receive high levels of use in winter. Nearly 92,000 acres of year-round recreation emphasis areas are located within designated critical habitat for lynx. Some of these areas are popular for winter recreation, but not all are within the persistent snow element, and not all are open to motorized, over snow use. Roughly 22,200 acres of the year round REAs within designated critical habitat are linear areas associated with major roads and/or rivers, where winter access is good, and consequently these areas have been impacted by winter recreation for years. While levels of use (numbers of recreationists) may increase within these linear REAs, the area impacted is not expected to increase significantly, because the attraction is often associated with the corridor itself in some places (e.g. river views), terrain is limited (steep canyons), or, as in the case of the Main Boulder REA, the corridor is surrounded by designated wilderness. Larger, nonlinear recreation emphasis areas in designated critical habitat include Storm Castle and Hyalite. The Storm Castle REA is over 34,000 acres, most of which is open to over snow motorized use, and heavily used by snowmobilers and other winter recreationists. The Hyalite REA is just under 34,000 acres, of which about half is open to over snow motorized use. The upper portion of the Hyalite REA is non-motorized, but there are a number of groomed ski trails in the portion closed to motorized use. All of these areas are expected to contribute snow compaction impacts that may affect PCE 1b, but again, while numbers of users may increase over the life of the plan, general areas of use are not expected to increase significantly, as no changes would occur to existing travel plans, and new designated over snow routes would be restricted by plan components adopted from the NRLMD (Guideline HU G11).

As noted previously, roughly 84 percent of the persistent snow element in critical habitat is in Recreation Opportunity Spectrum classes that do not allow winter motorized recreation, and where snow grooming for skiing occurs, but is rare. It is reasonable to assume the remaining 16 percent of this PCE would be affected by snow compacting human uses to some degree, including use within recreation emphasis areas. The revised plan includes a desired condition for sites, locations and seasons of operation for developed recreation areas to anticipate and respond to potential climate changes that could affect recreation uses and associated demands, while also considering impacts of changing recreation patterns on wildlife habitat and other resources (FW-DC-RECDEV 09). A related guideline (FW-GDL-REA 01) would require that temporary roads, skid trails and landings constructed for resource management within REAs would be designed and rehabilitated after use to discourage new visitor use patterns. A complementary guideline adopted from the NRLMD (VEG G4) states that prescribed fire should not create permanent travel routes that would facilitate snow compaction in lynx habitat, and that constructing permanent fire breaks on ridges or saddles should be avoided. Collectively these plan components would limit the potential for new user-created winter routes to contribute to snow compaction within REAs and other areas in designated critical habitat.

Winter access for non-recreational special uses such as research, or monitoring, and/or activities associated with mineral and energy exploration and developments, may also contribute to snow compaction in designated critical habitat. Most non-recreational special use permits cover very small

areas relative to the large landscape scale used by lynx. The Stillwater complex in the AB GA is the primary producer of platinum and palladium in the United States, and one of only three such producers in the world. As such, the Stillwater area is recognized in the revised plan through forest plan allocation as a mining emphasis area. The Stillwater Complex mining emphasis area is nearly 102,000 acres in size, of which, over 86,000 acres are located in designated critical habitat for lynx, largely overlapping the persistent snow element. This area has seen some level of mining operations since the late 1800s, with existing commercial operations in place since 1986 at the Nye Mine, and since 2003 at the East Boulder Mine. Expansion of these mines, or development of new mining operations within the Stillwater Complex could result in additional snow compaction in PCE 1b. The revised plan includes a standard that the extent and mode of access for future mineral activity be commensurate with the state of mining activities (FW-STD-EMIN 02), while complementary plan components adopted from the NRLMD (Guidelines HU G4, HU G12) encourage remote monitoring of mineral and energy developments in winter, and advocate use of existing designated routes for winter access to special uses, including mineral and energy exploration and development. These plan components would help to maintain human-caused snow compaction authorized by Forest Service permits at or near existing levels, and provide a basis for mitigation measures on future mining applications to minimize related impacts to PCE 1b.

PCE 1c. Sites for denning with abundant coarse woody debris.

Lynx reproductive denning habitat is characterized by large amounts of coarse woody debris such as downed logs and root wads from fallen trees (ILBT 2013). This habitat component can occur over a range of successional stages in forest habitat. Due to recent large-scale ecological 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 is generally abundant and well-distributed in designated critical habitat for lynx, with equally abundant standing dead trees available to contribute to coarse woody debris over time. While no lynx den sites are known from the Custer Gallatin, lynx den sites elsewhere have been located in a wide variety of habitat conditions (Ibid), and therefore, denning habitat does not appear to be a limiting factor at the relatively large landscape scale used by lynx (USDI FWS 2014). Management actions implemented under the revised plan with potential to impact lynx denning habitat (PCE 1c) would primarily be vegetation management actions that involve removal of dead standing or dead down trees.

Coarse woody debris has a variety of ecological functions, and the revised plan includes in number of plan components that could affect future availability of this habitat element. The revised plan contains a desired condition that coarse woody debris is present across forested landscapes, in variable amounts, sizes, and stages of decay, specifically noting the importance of this habitat component for wildlife, including the Canada lynx (FW-DC-SOIL 03). Guidelines are included for retention of coarse woody debris after timber harvest (FW-GDL-SOIL 07), varying by site capability. These components are complementary to NRLMD Guideline (VEG G11) that large woody debris components that provide important structure for denning habitat, be well distributed across the landscape (i.e. present in each LAU). In addition to plan components for coarse, woody debris (i.e. down material), the revised plan includes desired conditions for the presence of snags (dead standing trees), large live trees, insect and disease events, and old growth forest (FW-DC-VEGF 05, 07, 08 and 09) that would provide recruitment material for coarse woody debris over time, as well as guidelines that specify retention levels, and/or impose restrictions on vegetation management actions that could affect these habitat components (FW-GDL-VEGF 01-05). Desired conditions for wildland fire to occur and for vegetation to support natural fire

regimes (FW-DC-FIRE 01, 02) would promote natural ecological disturbance processes that contribute to denning habitat components.

Revised plan objectives for fuel reduction (FW-OBJ-FIRE 01) emphasize protection of human values at risk, and projects implemented to achieve the objective would be most common in WUI areas. Fuel reduction projects in WUI would potentially remove coarse woody debris, which would reduce the suitability of treated areas as denning habitat for lynx. Fuel reduction projects could also occur outside of WUI areas, but such projects would be more likely to focus on removing fine fuels and/or ladder fuels, which don't contribute greatly to lynx denning habitat per se. Plan components adopted from the NRLMD (Standards VEG S1, S2, S5 and S6) would preclude such project outside of WUI from reducing existing snowshoe hare habitat through removal of fine fuels and ladder fuels, which would help maintain the quality of PCE 1c, since proximity to snowshoe hare habitat affects the quality of denning habitat (USDI FWS 2014).

The amount of potential lynx habitat in designated critical habitat that is within the suitable base for timber production is estimated to be approximately 124,430 acres, which is about a 13% reduction from what is available in existing plans (143,581 acres). The revised plan would limit the conditions under which regeneration harvest occurs, and the size of openings created by clear-cutting and other regeneration harvest methods (FW-STD-TIM 04, 08), which would limit the types of treatment that would remove all or most of the trees, including those that currently, or eventually could contribute coarse woody debris for lynx denning habitat. The revised plan also contains guidelines for salvage harvest after fires, to retain some trees in unburned patches, as well as to retain clusters of burned (dead or dying) trees, including some large and very large trees to provide habitat for wildlife (FW-GDL-TIM 02), which would help maintain the key components of PCE 1c.

Permanent developments on NFS lands that have the potential to affect PCE 1c on a scale proportionate to the large landscapes used by lynx, would generally be associated with large developed recreation areas, such as ski areas, large campgrounds, etc. Such developments could remove existing lynx denning habitat, as well as reduce potential future habitat. As described above for PCE 1a, such projects would be limited by the large proportion of designated areas and forest plan allocations in designated critical habitat that would not allow large, permanent developments that would result in habitat loss. The revised plan contains direction to accommodate future demands for developed recreation opportunities (FW-DC-RECDEV 02), but also indicates that new developed sites would be located within existing high human use corridors to keep recreation use concentrated rather than shifting development to other areas (FW-DC-RECDEV 06). New or expanded recreation development under the revised plan could result in permanent loss of potential lynx habitat, thus reducing the amount of existing and/or potential denning habitat (PCE 1c), but plan components adopted from the NRLMD support good distribution of lynx denning habitat (Guideline VEG G11) and contain provisions specific to ski area development to retain patches of suitable denning habitat for lynx (NRLMD Guideline HU G1).

Effects of recreation on lynx are not well understood, and individual female lynx may respond differently to human disturbance near reproductive den sites (ILBT 2013). However, research has shown that that lynx den sites are typically located in remote areas further from roads and other developments (Squires et al. 2008, 2010; Olson et al. 2011 *cited in* ILBT 2013). The lynx's possible preference for more remote areas for reproductive den sites suggests that revised plan components that serve to concentrate human use and developments would have less impacts on lynx and PCE 1c than allowing such use to become more dispersed throughout designated critical habitat.

PCE 1d – Matrix Habitat

The matrix element of designated critical habitat for lynx is the dry forest, deciduous forest, and non-forest habitat types that do not support snowshoe hare populations of sufficient density for persistent use and occupation by lynx. Matrix habitat occurs between patches of boreal forest at a scale proportionate to a lynx home range (LAU scale) such that resident lynx are likely to travel through such habitat while accessing patches of boreal forest. The general condition of matrix habitat is not thought to be a limiting factor for lynx, and human activities that change vegetation structure within matrix habitat are not considered to have an adverse effect to critical habitat unless they create a barrier, or otherwise impede lynx movement between patches of foraging habitat or between denning and foraging habitat, or if impacts to matrix habitat would adversely affect adjacent foraging or denning habitat (USDI FWS 2014). Management actions on Forest Service lands within designated critical habitat that have the potential to affect PCE 1d include vegetation management projects that result in large openings, large recreational developments that include permanent infrastructure (e.g. ski areas, large developed campgrounds, etc.), major mining operations and associated infrastructure, and any projects with long-term impacts on linkage areas, such as new permanent roads that would accommodate high traffic volume and speed.

Matrix habitat is, by definition, the habitat lynx move through to access patches of boreal forest (USDI FWS 2014). Daily movements within a home range center on continuous forest, and often involve travel along ridges, over saddles, and within riparian areas (ILBT 2013). Residential lynx may avoid moving through or across large openings (Squires et al. 2010, ILBT 2013), whereas long-distance (exploratory and/or dispersal) movements by lynx often involve travel across large areas lacking potential lynx habitat (Ward and Krebs 1985 *cited in* ILBT 2013, Rudiger et al. 2000, Vanbianchi et al. 2018).

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). To address these requirements to provide for connectivity, the revised plan takes a more affirmative, proactive approach to maintain or restore habitat connectivity for wildlife, which would apply in designated critical habitat for lynx, and would serve to maintain the suitability of matrix habitat for lynx to move within and between LAUs. The topic of how the revised plan would limit habitat fragmentation for lynx, and thereby maintain habitat connectivity was addressed in detail above under Tier 1 impacts to lynx habitat. That analysis is applicable to impacts on lynx critical habitat as well, including effects to matrix habitat, and will not be repeated in its entirety here. In summary, the revised plan contains integrated resource desired conditions to provide wildlife habitat, forested vegetation, non-forested vegetation, riparian areas, and ecological disturbance processes within the natural range of variation (FW-DCs: WL 03; VEGF 02, 06; VEGNF 04; WTR 04, 06, 07; and FIRE 01), and to provide for habitat connectivity (FW-DCs: WL 05-07; WTR 02, 10; VEGF 06; LAND 01). These desired conditions, and associated management applications or restrictions would serve to maintain ecological characteristics within the historic range of conditions to which native species, such as lynx and snowshoe hares, have evolved.

Specifically, the revised plan contains measurable indices to maintain or restore natural structural characteristics in warm, dry, and cold forest types that provide matrix habitat. Plan components spell out management sideboards related to successional stage, forest density, presence of snags, patch size, distribution of large trees, natural disturbance processes, and presence of old growth forest (FW-DC-VEGF 03-09). Similar plan components are provided for deciduous woodlands, shrublands, riparian areas and wetlands that may occur within matrix habitats (FW-DC-VEGNF 04; FW-GO-VEGNF 03; FW-OBJ-VEGNF 01; FW-DC-RMZ; FW-STD-GRAZ 01). Complementary direction is adopted from the NRLMD (Guideline LINK G2) which addresses grazing management practices that could impact shrub-steppe structure and condition within matrix habitat. Collectively these factors would all influence the amount of vegetative cover available to provide potential travel routes and resting areas for lynx, as well as suitable habitat for alternate lynx prey species, such as squirrels, grouse, and other species that may be present in matrix habitats.

The NRLMD identified linkage areas for lynx at a large landscape scale, often pointing to areas outside the national forest boundaries (NRLMD Figure 1-1). For the first time, the revised plan includes land use allocations and associated plan components for key linkage areas inside the CGNF boundaries, which are intended to maintain or restore habitat connectivity to provide long-term travel corridors for many wide-ranging species, including Canada lynx. Part of the key linkage area identified on the CGNF falls within designated critical habitat for lynx, at the north end of the Gallatin Mountain Range. Management direction for key linkage areas (FW-GDL-WL 02-05) would apply to matrix habitat as well as to lynx habitat elements. Additional plan components apply outside the key linkage areas as well, including a forest-wide guideline that management actions should not create movement barriers to wide-ranging species (FW-GDL-WL 01), as well as numerous goals to work with partners across administrative boundaries to maintain or restore habitat connectivity for wildlife (FW-GO-WL 02, 03, 05). Much of this direction is forest-wide, and applies not only to boreal forest types with potential lynx habitat, but would apply equally to matrix habitats as well. Collectively, these plan components would serve to minimize large scale habitat alterations and permanent developments that could impede lynx movement through matrix habitats across the landscape within designated critical habitat.

Temporary habitat alterations could affect individual lynx's willingness to travel through and ability to find suitable prey within affected matrix areas, but generally would not occur at a scale that would create a barrier or otherwise impede lynx movement across the landscape within designated critical habitat. Permanent habitat alterations, such as large-scale permanent recreation developments (e.g. ski areas), large-scale mining operations, or permanent roads that accommodate high speed and high-volume traffic, could impede lynx travel through matrix habitat. Under the revised plan a large proportion (84%) of all designated critical habitat falls within designated wilderness or other land use designations/forest plan allocations that either preclude, or limit the scale of permanent developments. An even larger proportion (90%) of matrix habitats fall within areas with some type of restriction on permanent developments (table 19). Permanent habitat losses due to recreational developments would further be limited by plan components that apply to the remaining ten percent (where some development is allowed), which would preclude development of new recreation residence areas (FW-STD-RECRES 01), limit consideration for new ski resorts (FW-STD-RECSKI 01), and focus new permanent developments in areas already receiving concentrated human use (FW-DC-RECDEV 06). Additional development within the existing Red Lodge Mountain developed ski area would have minimal impacts on lynx movement through matrix habitat, since the resort is located at the very edge of designated critical habitat.

Large-scale mining operations may also result in habitat alterations that could affect lynx travel between patches of suitable habitat. Such habitat alterations may exist on the landscape for multiple generations of lynx. However, the revised plan includes desired conditions for mining and renewable energy developments to be restored to productive capacity after use (FW-DC-EMIN 01, 02) and requires that no new mineral or energy developments be authorized without reclamation plans with provisions to return disturbed areas to pre-operational site conditions (FW-STD-EMIN 01). These components would neither preclude major habitat alterations that may affect lynx movement across matrix habitat, nor limit the duration of such impacts on the landscape, but would provide for restoration to habitat suitable for lynx travel upon completion of permitted operations. The Stillwater Complex would have forest plan allocation as a mining emphasis areas, and would therefore be an area where additional, potentially large-scale habitat alterations could be expected to affect PCE 1d over the life of the plan. Such development has potential to affect individual lynx movement patterns to some degree, but because the Stillwater Complex is located at the edge of designated critical habitat, impacts to lynx movement throughout the designated critical habitat unit would be minor.

Road upgrades that would increase traffic speed and/or volume in critical habitat could have adverse impacts on lynx due to increased mortality risk should lynx attempt to cross these roads (USDI FWS 2014). National Forest System roads are categorized by their associated maintenance levels (ML). 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. There are just over ten miles of ML 5 road within designated critical habitat on the CGNF, which is a miniscule amount at over 1.3 million acres of designated critical habitat. Road ML 4 allows for a moderate degree of user comfort, which means less bumps and ruts that may limit traffic speed. These types of forest roads are generally popular and receive considerable levels of traffic, but are notably lower in speed and traffic volume than maintenance level 5 roads. There are just under 21 miles of maintenance level 4 roads in designated critical habitat for lynx. At about 31 miles combined, ML 4 and 5 roads have minimal potential to affect habitat connectivity across over 1.3 million acres of designated critical habitat for lynx. Road ML 3 is suitable for passenger vehicles, but narrow lanes, limited sight distance, and rougher driving surface limits traffic speed and volume on these roads. Road ML 2 is suitable only for high clearance vehicles, with variable road surfaces including large rock, ruts and steep grades that notably limit vehicle type, and associated levels of traffic volume and speed. Nearly 73 percent of the Forest System road miles within designated critical habitat for lynx are ML 2, and 95 percent of the road miles are ML 2 and 3 combined.

Eighty-four percent of the designated critical habitat for lynx is within designated areas or forest plan allocations where no new roads would be allowed. Only nine percent of the total designated critical habitat is within Recreation Opportunity Spectrum classes of Roaded Natural or Rural, which are the classes that allow roads with maintenance levels greater than ML 2. Less than six percent of matrix habitat would allow for road maintenance level 4 or 5 roads to be built that could accommodate higher speeds and traffic levels of greatest mortality risk to lynx. The revised plan contains no direction that would directly or indirectly result in upgrades to road maintenance levels that would increase traffic volume or speed, but rather has objectives to maintain roads at existing maintenance levels (FW-OBJ-RT).

In addition to these plan components within the Forest boundary, the revised plan contains a goal to work with highway managers, states, Tribes and private landowners to implement wildlife road

(highway) crossings where needed to reduce wildlife mortality due to vehicle collisions (FW-GO-RT 03). The Northern Rockies Lynx Management Direction applies to all NFS lands that are known to be occupied by Canada lynx (USDA 2007). While most components adopted from the NRLMD apply specifically to lynx habitat, others apply to all projects within linkage areas, which can include matrix habitat within designated critical habitat. The NRLMD specifically addresses management issues associated with matrix habitat relative to linkage areas by incorporating direction to work across administrative boundaries to conserve lynx habitat connectivity (Objective LINK O1, Guideline LINK G1), and limit impacts from roads designed for high traffic volume and speed (Standard LINK S1).

Cumulative Effects

Cumulative effects under the Endangered Species Act include state, Tribal, local or private actions that are reasonably certain to occur in designated critical habitat for lynx. Much of the cumulative effects analysis provided for lynx and lynx habitat above is applicable to designated critical habitat for lynx, and will not be repeated in its entirety here. In Montana, all Tribal and State lands managed in accordance with the Montana Department of Natural Resources and Conservation Forested State Trust Lands Habitat Conservation Plan were excluded from the designation of critical habitat for lynx (USDI FWS 2014). In Unit 5 (Greater Yellowstone Area) of lynx critical habitat, there are roughly 23 square miles (14,720 acres) of state lands and about 200 square miles (128,000 acres) of private land, that make up approximately 2.5 percent of the designated critical habitat for lynx. Approximately 111 square miles (70,872 acres), or nearly half of the non-federal lands in Unit 5, fall within the boundaries of the Custer Gallatin National Forest. These lands account for approximately 5 percent of the designated critical habitat for lynx inside the CGNF boundary, and include state-owned wildlife management areas, private land and land owned by the city of Bozeman. Future human activities on these lands have the potential to adversely affect designated critical habitat for lynx through management actions that remove understory vegetation providing snowshoe hare habitat, large-scale developments that result in permanent loss of lynx habitat and/or create barriers to lynx movement, or road development and/or upgrades that facilitate increased traffic volume and speed in a manner that divides critical habitat for lynx.

The Montana Fish Wildlife and Parks State Wildlife Action Plan (MTFWP 2015) identifies coniferous forests and riparian areas as habitats and/or community types of greatest conservation need, regardless of land ownership. The primary goal of Montana's state-owned Wildlife Management Areas is to maintain vital wildlife habitat for the protection of species and enjoyment of the public (<http://fwp.mt.gov>). Wildlife habitat improvement projects on state lands may involve removal of conifers when targeting species other than lynx, but such projects are more likely to occur in naturally non-forested areas affected by conifer encroachment, or dryer forest types that are naturally more open and do not provide lynx habitat PCEs. Given state identification of coniferous forest as a high priority for conservation, coupled with state goals for protecting species on wildlife management areas, future projects on state lands would not likely contribute adverse effects to designated critical habitat for lynx.

All five Montana counties that overlap designated critical habitat for lynx on the CGNF (Gallatin, Park, Sweet Grass, Stillwater and Carbon counties) have Community Wildfire Protection Plans (CWPPs), which identify areas on non-federal lands in greatest need of fuel reduction treatment, and recommend effective and efficient measures to reduce fire risk to man-made structures (USDA 2004). CWPPs could encourage non-federal land owners to conduct fuel treatment projects in lynx habitat that may reduce snowshoe hare habitat, or otherwise temporarily or permanently alter lynx habitat. Forestry

management projects on non-federal lands have the potential for additional adverse effects in designated critical habitat for lynx, but state and county land management plans encourage responsible forestry practices, and such impacts are expected to occur at a small scale relative to the large landscapes used by lynx.

State regulations for hunting and trapping of wildlife apply on non-Federal lands. The fur trapping season for lynx has been closed in the state of Montana since 2000, and trapping regulations for other fur-bearing species have been revised to minimize the potential for lynx to get caught in legally set traps. Any lynx unintentionally caught in a trap set for another species must be immediately released if unharmed, and reported to a Fish Wildlife and Parks warden or biologist regardless of condition (Montana FWP 2018).

Human population growth is increasing at a dramatic rate in the Greater Yellowstone Area. Montana Counties overlapping CGNF lands within designated critical habitat for lynx have growth policies, with all but one (Stillwater) including provisions to conserve wildlife habitat as noted above in cumulative effects for lynx. Large-scale permanent developments to accommodate human population growth could occur on non-federal lands in designated critical habitat for lynx, with associated potential for adverse effects on primary constituent elements. The city of Bozeman also has a Growth Policy (2009), which includes an objective to protect important wildlife habitats, such as watercourses, wetlands, riparian areas and floodplains, and notes that protecting wildlife corridors with conservation easements has become a growing trend. The growth plan acknowledges the importance of maintaining an adequate buffer between the city and National Forest System lands to reduce the risk of wildland fires burning homes and commercial buildings. It should be noted that this document focuses on the urban area within the city limits, which is outside of designated critical habitat for lynx. However, the city of Bozeman owns nearly six sections of land within the Forest boundary that are in designated critical habitat for lynx. These lands are primarily managed to protect the municipal water supply for Bozeman residents. Forest management practices, and/or large scale developments on city-owned lands could contribute adverse impacts to designated critical habitat for lynx.

Determination of Effect – Designated Critical Habitat for Canada Lynx

Implementation of the programmatic management direction provided in the revised Custer Gallatin Forest Plan ***may affect, and is likely to adversely affect designated critical habitat for Canada lynx.***

Rationale for the determination

PCE 1a – snowshoe hare habitat – could be adversely affected as a result of implementing projects using exemptions for standards adopted from the Northern Rockies Lynx Management Direction (Standards VEG S5 and S6) to allow for fuel reduction treatment in the wildland urban interface. WUI treatment exemptions in critical habitat could occur over the life of the plan and could affect up to 34,436 acres of lynx habitat. Snowshoe hare habitat could also be adversely affected as a result of implementing projects using exceptions to standards adopted from the NRLMD (VEG S5 and S6) for the benefit of other resources. These exceptions could affect up to 2,260 acres of snowshoe hare habitat over the life of the revised plan.

Effects to PCE 1b – deep, soft snow – would be insignificant, because expansion of snow compaction due to human uses would be limited, and activities that increase snow compaction would be discouraged in designated critical habitat.

Effects to PCE 1c – lynx denning habitat – would be insignificant because lynx denning sites have been located in a wide variety of habitat conditions, and denning habitat does not appear to be a limiting factor in critical habitat (USDI FWS 2014). Coarse woody debris, which seems to be the key ecological characteristic of lynx denning habitat, is abundant and widespread on the CGNF. Plan components would ensure that this element would be maintained and well distributed over the life of the plan.

Effects to PCE 1d – matrix habitat – would be insignificant because matrix habitat is not thought to be limiting to lynx, and activities that change vegetation structure and condition of matrix habitat are not considered to adversely affect lynx critical habitat unless they create a barrier to movement or impede lynx movement between lynx habitat elements (USDI FWS 2014). The revised plan includes direction to manage vegetation within the natural range of variation in which lynx have evolved, and not to create barriers to movement for wide-ranging species such as lynx.

Grizzly bear

Species status and ecological information

Population status and distribution

Grizzly bears occur throughout northwestern North America, from Alaska and northern Canada, south into the Northern Rocky Mountains and North Cascades. In 1975, the grizzly bear was listed as a threatened species in the contiguous 48 United States. There are six grizzly bear recovery zones identified in the Grizzly Bear Recovery Plan (USDI FWS 1993), including the Greater Yellowstone Ecosystem (GYE) in southwestern Montana, northwestern Wyoming and eastern Idaho; the Northern Continental Divide Ecosystem (NCDE) in north-central Montana; the North Cascades area of north-central Washington; the Selkirk Mountains in northern Idaho and northeastern Washington; the Cabinet-Yaak area of northwestern Montana and northern Idaho; and the Bitterroot Ecosystem in western Montana and central Idaho. Of these, all but the Bitterroot Ecosystem are considered occupied by grizzly bears, although only the GYE and NCDE have substantial populations (USDI FWS 2017a).

Habitat requirements and life history

There is no critical habitat designated for grizzly bears. The FWS proposed to designate critical habitat for grizzly bears in 1976, but the proposal was never finalized. Rather, the Interagency Grizzly Bear Committee (IGBC) established habitat management guidelines for all occupied grizzly bear habitat in 1986, which contributed to successful recovery efforts (USDI FWS 2017a). Grizzly bears are habitat generalists that employ an opportunistic, omnivorous foraging strategy by using a wide range of plant and animal food sources (Guenther et al. 2014). Although grizzly bears in the GYE 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 carcasses), spawning cutthroat trout (*Oncorhynchus clarkia*), whitebark pine seeds, and army cutworm moths (*Euxoa auxillaris*) (Schwartz et al. 2010, van Manen et al. 2013, Costello et al. 2016). In the GYE, significant grizzly bear use of spawning

cutthroat trout is known to occur only inside Yellowstone National Park, and use of army cutworm moths occurs in relatively small insect aggregation sites found in the Wyoming portion of the ecosystem (van Manen et al. 2019, M. Haroldson 2019, pers. comm).

Ungulate carrion provides one of the highest sources of concentrated food energy for GYE grizzly bears. Use of this food source peaks in spring, when it is most available on the landscape in the form of winter-killed animals (Mattson et al. 1991, Mattson 1997, and Green et al. 1997; *cited in*: van Manen et al. 2018). Re-establishment of wolf populations in the GYE during the mid- to late-1990s influenced the number of winter-killed ungulate carcasses available for grizzly bears upon den emergence. While wolf depredation reduced the number of winter-killed elk and bison in the GYE, more ungulate carcasses became available to bears during the non-denning season (spring, summer and fall) as bears began to usurp wolf kills (Gunther et al. *in* van Manen et al. 2018). 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 mast seeding tree species that is cyclic, producing a large seed crop every 2 to 3 years. 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. In recent years, whitebark pine has been notably impacted within the GYE, including areas on the Forest. Impacts are primarily due to infestation by mountain pine beetle (*Dendroctonus ponderosae*) and, to a lesser degree, from invasion of an exotic fungus (*Cronartium ribicola*) that causes white pine blister rust. Fortunately, there is evidence that whitebark pine mortality levels may be diminishing (Schwartz et al. 2014). Fire exclusion (through suppression) and climate change have also impacted whitebark pine, creating conditions more favorable to shade tolerant tree species that compete with whitebark (USDI FWS 2011, van Manen et al. 2013, Hansen et al. 2018).

While ungulate biomass and whitebark pine are of high importance to grizzly bears across the GYE, these food sources are not evenly available on a spatial or temporal scale. These, and other high-calorie, energy-rich food sources are typically not available in all areas, and frequently not of sufficient or predictable quantity to support all grizzly bears across the GYE from year to year. Such annual variation is why the highly adaptable foraging strategy of grizzly bears serves the species well. Where and when these key food sources are limited, 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).

Gunther and others (2014) documented 266 species of plant, animal, fungi, algae and soil consumed by grizzly bears in the GYE. Some of these food items were incidental, and believed to be consumed through exploratory behavior or accidentally during consumption of other foods. The most frequent 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 present and widely distributed

across the plan area. Although berries are noted in the GYE grizzly bear diet (Ibid; Costello et al. 2016), the GYE 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 plan area as well.

Climate change is a factor in availability of grizzly bear food sources, with potential to further 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 others 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). Climate change and associated factors have been correlated to declines in whitebark pine distribution and seed production (see whitebark pine species assessment in this BA), and spring ungulate carrion is generally less available after mild winters in the GYE (Gunther et al. *in* van Manen et al. 2018). 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. Grizzly bear dens in the GYE 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 (Podruzny et al. 2002). 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 conflict if bears spend less time in dens (Cross and Servheen 2010).

Environmental Baseline

Population status and distribution in the action area

Grizzly bears on the Custer Gallatin National Forest are part of the Greater Yellowstone Ecosystem (GYE). Grizzly bears are only present in the AB and MHG Geographic Areas on the Custer Gallatin National Forest. They do not occur in the BBC, Pryors, Ashland or Sioux Geographic Areas. Grizzly bears in the GYE were identified as a distinct population segment and delisted in 2017 (USDI FWS 2017a). In 2018, a District Court ruling vacated the delisting rule, effectively restoring ESA protection for the Yellowstone grizzly bear population. The GYE grizzly bear population met demographic recovery targets by 1998, and has generally met or exceeded most recovery targets since (YES 2016). The GYE grizzly bear population is currently stable to increasing, with a total population estimate of 714 grizzly bears in 2018 (van Manen et al. 2019). 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 GYE grizzly bear population is nearing carrying capacity (van Manen et al. 2013).

Doak and Cutler (2014) questioned the methods used by the Interagency Grizzly Bear Study Team (i.e. van Manen et al.) to estimate grizzly bear population numbers and trends. They suggested that population increases reported in recent decades were likely due to increased survey efforts and improved ability to sight bears, rather than the result of actual increases in bear numbers. They also challenged Interagency Grizzly Bear Study Team methods of accounting for reproductive senescence (decreased reproductive fitness after a certain age), and ultimately concluded that the Greater

Yellowstone Ecosystem grizzly bear population has increased far less than reported by the agencies. van Manen and others (2014) on the Interagency Grizzly Bear Study Team responded to these critiques by demonstrating that the perceived increase in survey effort was attributed to a notable increase in grizzly bear distribution; i.e., bears occupying a much larger area required additional survey effort. They also noted that there is no empirical evidence to show that the probability of seeing grizzly bears has increased over time. Finally, van Manen and associates (Ibid) said their findings show minimal contribution of age-specific survival on population trends, and argued that Doak and Cutler (2014) chose extreme measures for reproductive senescence, which led to inaccurate conclusions that were not supported by empirical evidence. The Interagency Grizzly Bear Study Team grizzly bear population estimates and associated demographic analyses are conducted by a team of about a dozen scientists, using methods that are critically reviewed and evaluated. Therefore, we feel the population estimates provided by the Interagency Grizzly Bear Study Team are based on sound scientific principles, and present the best available scientific information for this assessment.

The GYE covers parts of Montana, Idaho and Wyoming surrounding Yellowstone and Grand Teton National Parks, and parts of five national forests, including the Custer Gallatin. The Grizzly Bear Recovery Zone is at the core of the GYE, covering an area of about 6 million acres, with just over a million acres inside the Custer Gallatin boundary. Grizzly bears began to expand beyond the GYE recovery zone in the early 1990s, moving into areas previously unoccupied for decades (Bjornlie et al. 2014). Expansion outside the recovery zone has continued in subsequent years, and as a result, the occupied range for grizzly bears has more than quadrupled since the 1970s (vanManen et al. 2019) and more than doubled from the 1980s to 2014 (Bjornlie et al. 2014).

Habitat conditions in the action area

The US FWS classified grizzly bears in the GYE as a distinct population segment (DPS), and identified the area in which this DPS occurs (figure 9). Custer Gallatin Geographic Areas south of Interstate 90 (AB, MHG and Pryor Mountain GAs) fall within the GYE DPS for grizzly bears, although grizzly bears are presently known to occur only in the AB and MHG GAs. The US FWS also identified suitable habitat for grizzly bears within the DPS. For the most part, suitable habitat is coincident with the demographic monitoring area for GYE grizzly bears (figure 9). The AB and MHG GAs on the Forest are within suitable habitat and the demographic monitoring area for GYE grizzly bears. The portion of the GYE grizzly bear recovery zone on the Forest is also within the AB and MHG GAs. Over 11 million acres of suitable habitat has been identified for grizzly bears in the GYE. Of that, about 6 million acres is inside the recovery zone (USDI FWS 2016a). Notably, the Custer Gallatin National Forest administers approximately 19 percent (over 2 million acres) of the total suitable habitat, and roughly 16 percent (nearly 1 million acres) of the area within the recovery zone for grizzly bears in the GYE. Approximately 94 percent of the Custer Gallatin portion of the recovery zone is National Forest System land, and of that, roughly 82 percent occurs within congressionally designated areas such as wilderness, wilderness study, and inventoried roadless areas that contain restrictions on land uses. Outside the recovery zone, roughly 91 percent of the current grizzly bear distribution area within the Custer Gallatin boundary is National Forest System land, and of that, about 77 percent falls within these same designated areas.

Grizzly bear distribution has been expanding on the Forest since the original (Custer and Gallatin) forest plans were implemented in the mid-1980s (figure 10 and figure 11), which is indicative of overall habitat conditions and connectivity. Current grizzly bear distribution covers nearly all of the suitable habitat in the AB and MHG GAs.

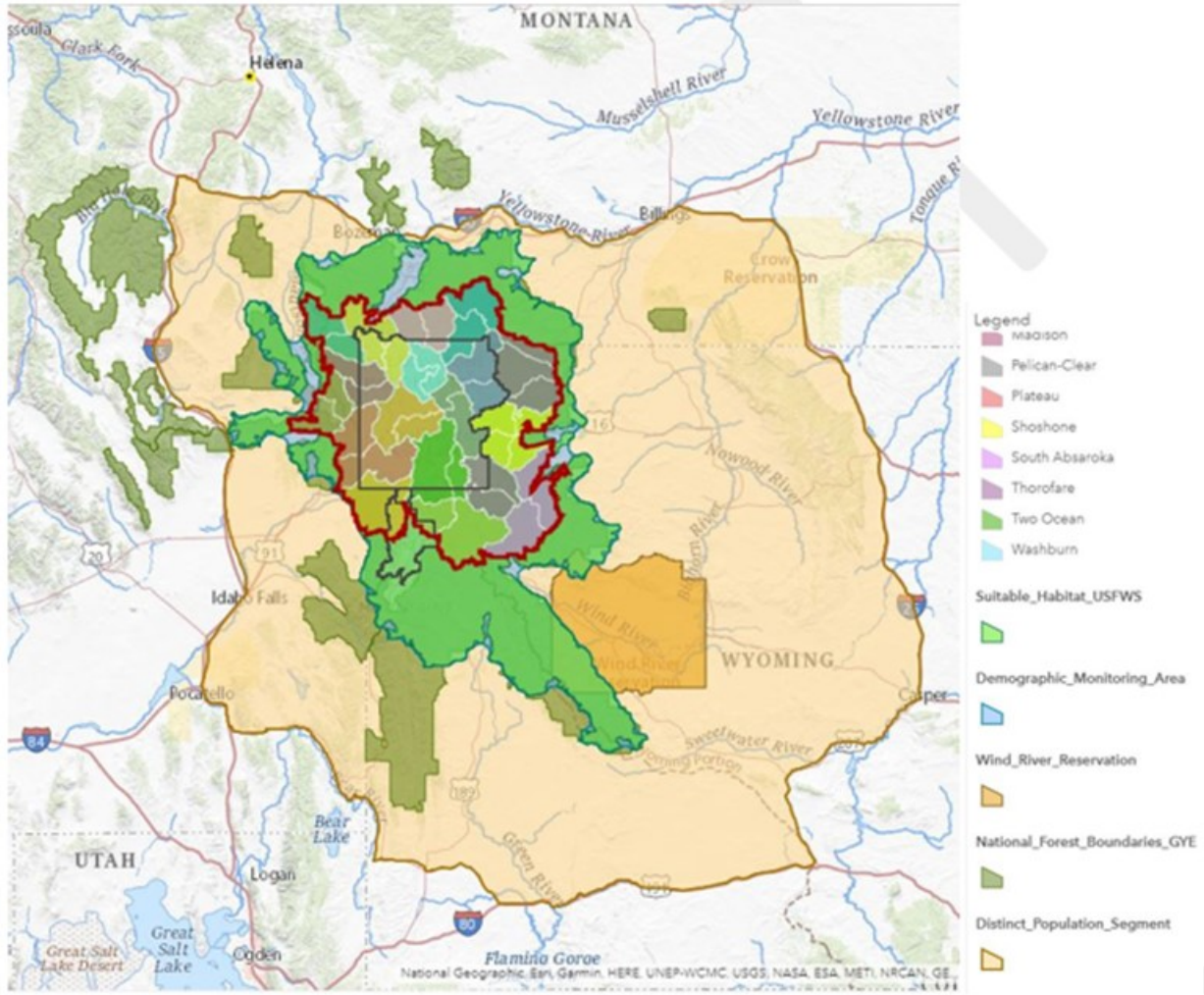


Figure 9. GYE Grizzly Bear Boundary Map (<https://usgs.maps/arcgis.com/home/webmap/viewer>)

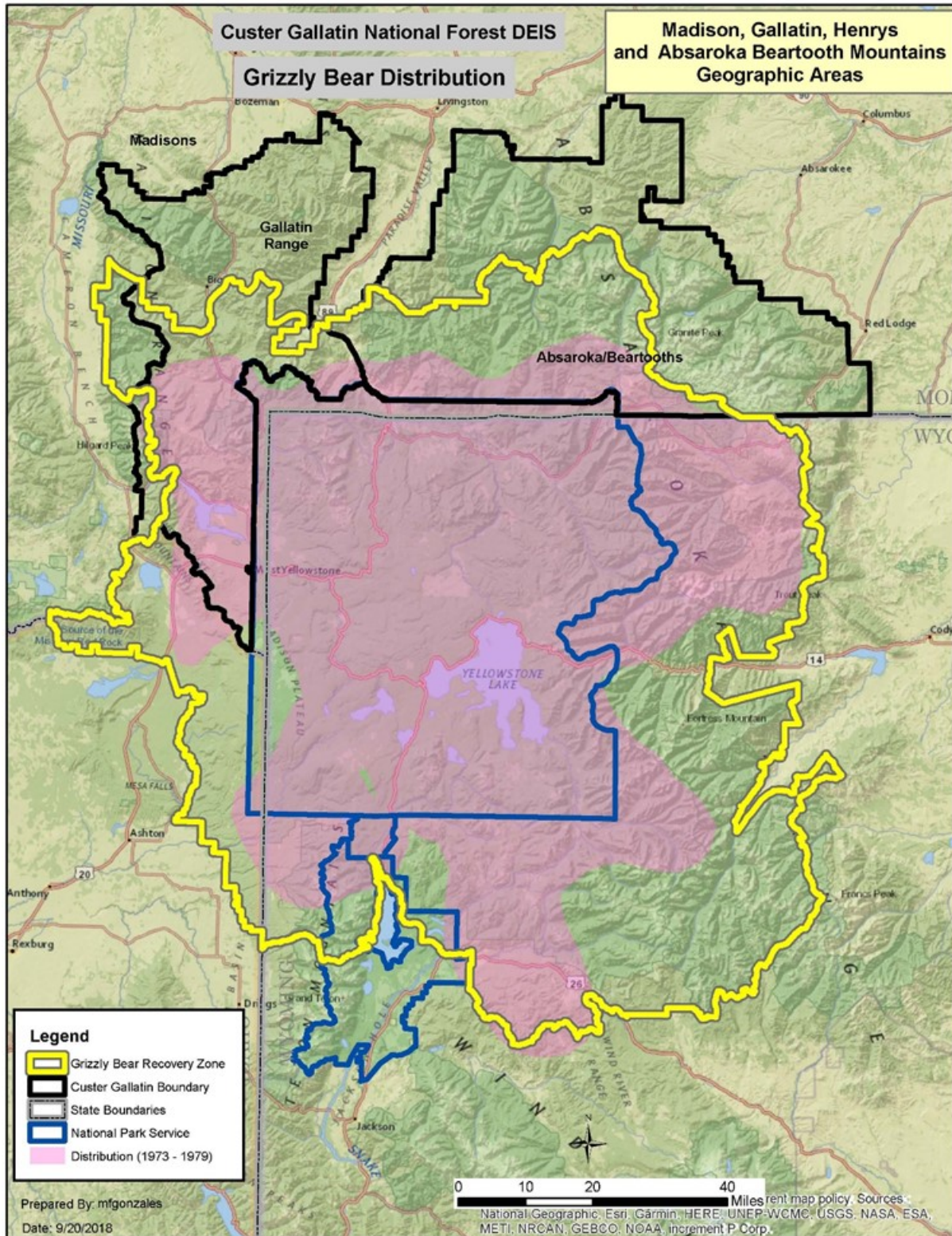


Figure 10. Grizzly bear distribution – 1970s (<https://www.usgs.gov/science/interagency-grizzly-bear-study-team>)

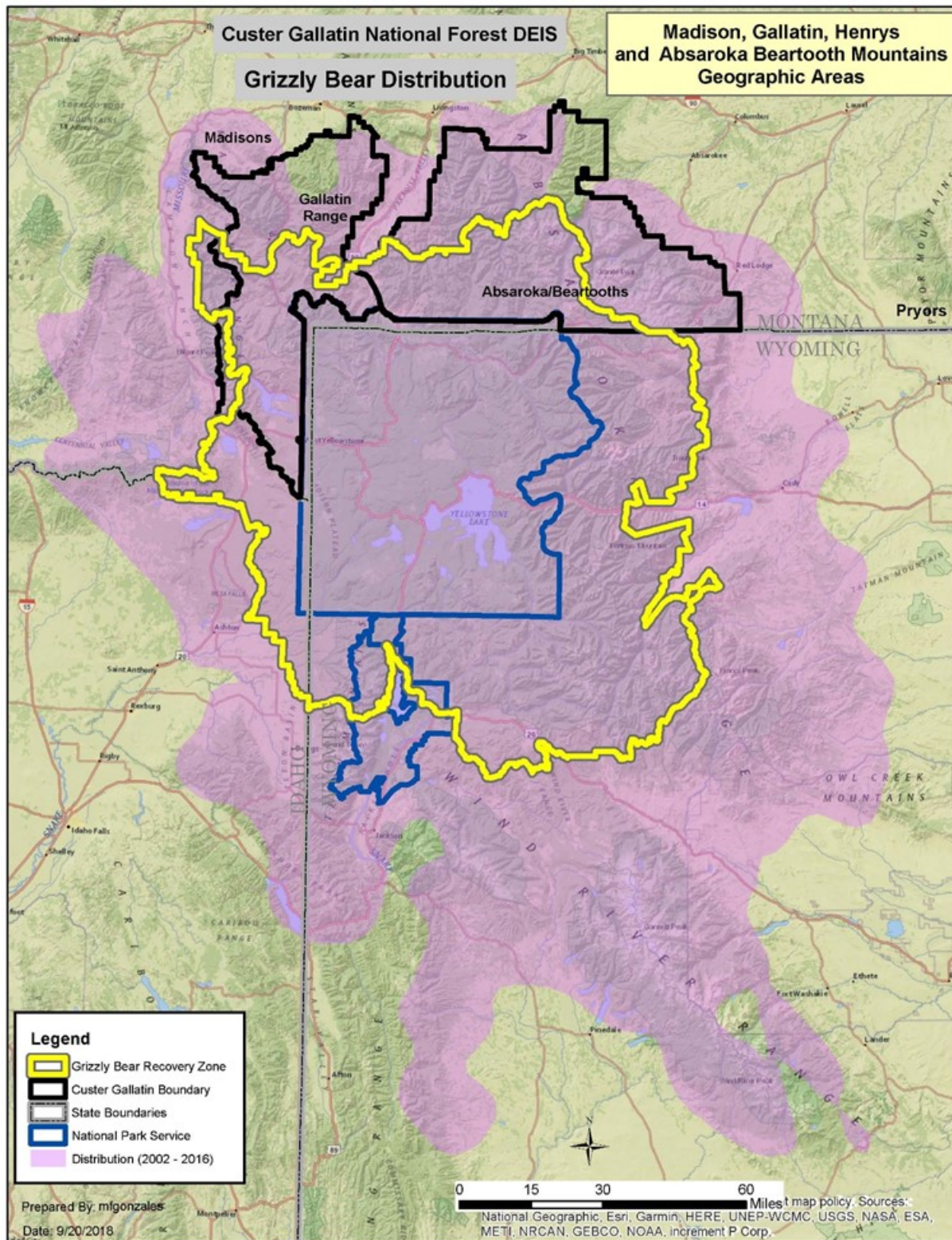


Figure 11. Current grizzly bear distribution (<https://www.usgs.gov/media/images/animated-image-showing-grizzly-bear-range-expansion-gye-1990-2018>)

Inside the recovery zone, bear management units (BMU) were delineated to facilitate the assessment of habitat characteristics and recovery objectives. BMUs represent the spatial scale of the lifetime home range of a female grizzly bear in the GYE. BMUs are further divided into subunits, which provide additional landscape resolution to account for seasonal differences in grizzly bear use patterns within a BMU (USDI FWS 2016a). The Custer Gallatin intersects 9 of the 18 BMUs and 14 of 40 subunits in the GYE recovery zone. BMUs and subunits on the Custer Gallatin average about 482 and 217 square miles in size respectively. Outside the recovery zone, bear analysis units (BAU) were developed to provide consistent analysis units for monitoring changes to grizzly bear habitat, and are roughly the size of BMU subunits (Schwartz et al. 2009). Eleven BAUs are monitored on the Custer Gallatin. Of these, eight are contiguous with the recovery zone, and are located in the AB and MHG GAs. Three additional BAUs encompass isolated mountain ranges in the BBC and PM GAs. Of these, the BBC GA is outside the GYE grizzly bear DPS, whereas the PM GA is inside the DPS, but is outside the Demographic Monitoring Area, and is not identified as suitable habitat for grizzly bears (USDI FWS 2017a). Figure 12 and figure 13 show the BMUs, subunits and BAUs used in this assessment.

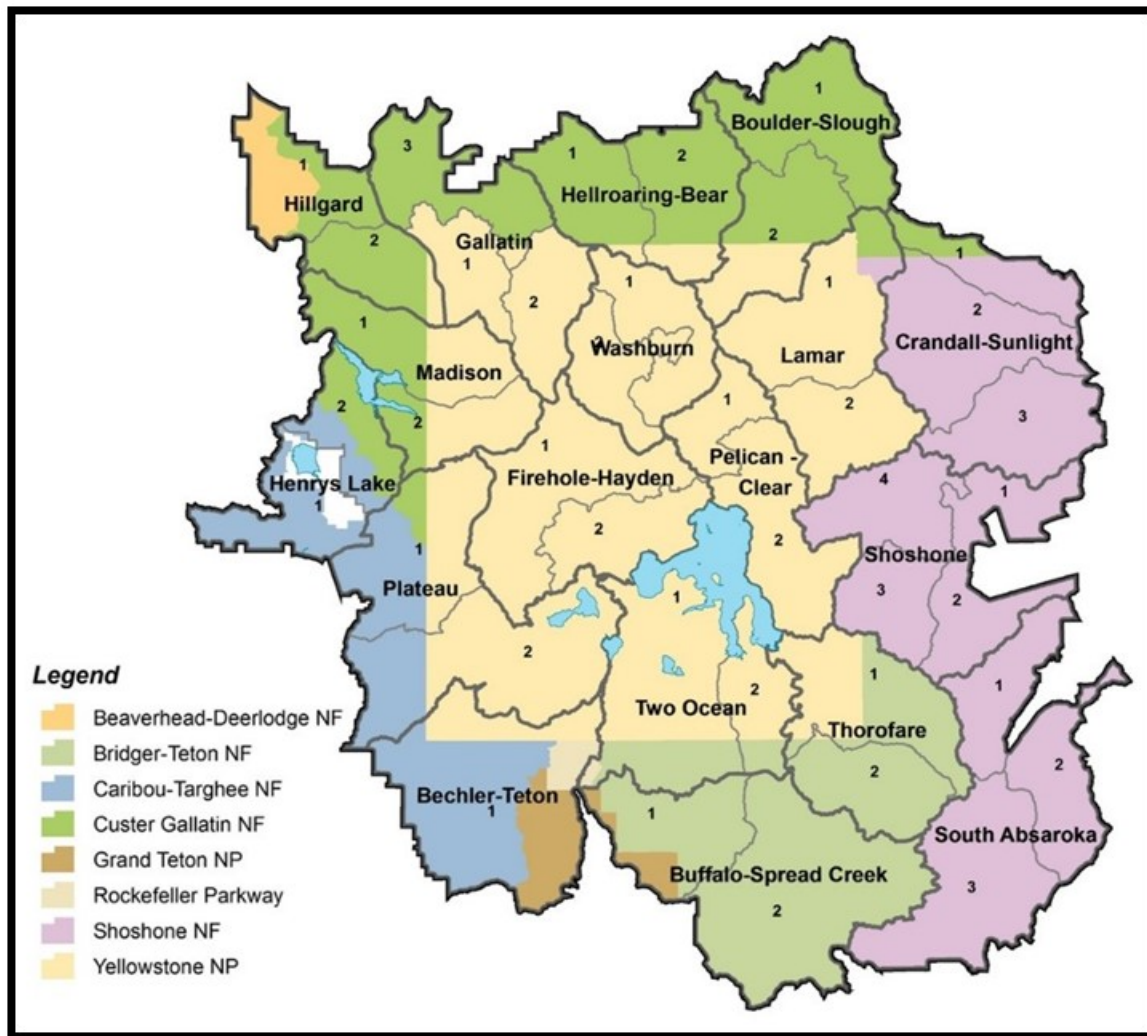


Figure 12. GYE Grizzly Bear Management Units and Subunits {vanManen et al. 2019}

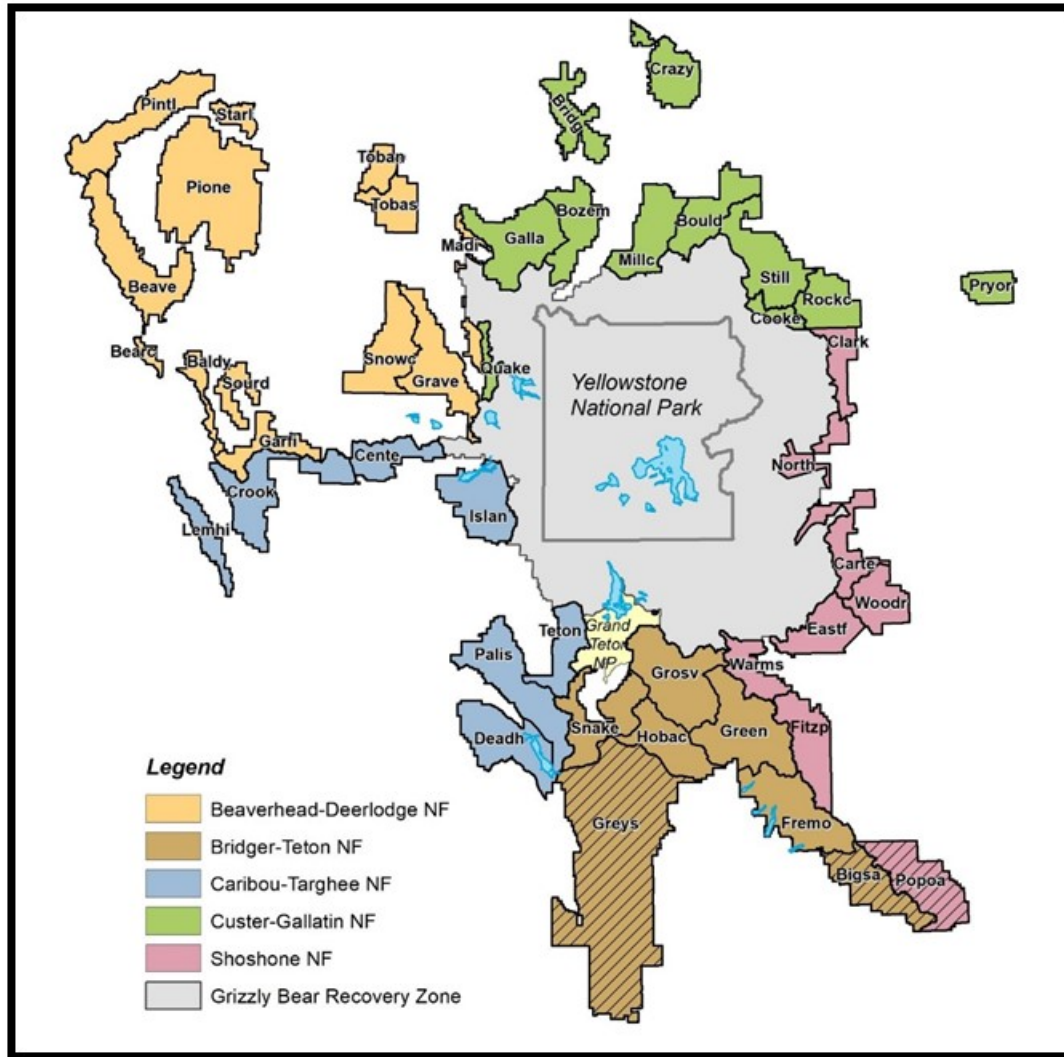


Figure 13. Bear Analysis Units – Outside the Grizzly Bear Recovery Zone (vanManen et al. 2019)

Current grizzly bear distribution on the Forest is limited to the AB and MHG GAs, which corresponds to the area that the US FWS identified the Demographic Monitoring Area, and that which contains suitable habitat for the GYE DPS of grizzly bears. Roughly 44 percent of the AB and MHG combined area is within the grizzly bear recovery zone. The other 56 percent is outside the recovery zone, but nearly all is within the current distribution area for grizzly bears. Although there is no estimate of the total number of grizzly bears currently using portions of the Custer Gallatin National Forest, grizzly bears are present and well distributed in the MHG and AB GAs, and currently occupy most of the suitable habitat within those GAs (figure 11). Inside the recovery zone, the best available information (van Manen et al. 2019) indicates that reproductive females with cubs of the year were present at least for the past six consecutive years in all nine of the BMUs intersecting the Forest. BMUs are large and often cover multiple administrative jurisdictions, so even though all nine BMUs covering the Custer Gallatin were occupied by females with cubs, these family groups were not necessarily all detected on the forest. However, there were at least seven unique female grizzly bears with cubs observed on the Custer Gallatin in 2018 (Ibid), most of which were located inside the recovery zone.

The broad diversity of habitat types across the Custer Gallatin and the larger GYE provides a wide variety of alternate food sources for bears to supplement their diet when key foods are less available or unavailable. Of the four key food sources identified for GYE grizzly bears, only ungulate biomass and whitebark pine are known to be important food sources for bears on the Custer Gallatin National Forest. Availability of ungulate biomass and whitebark pine varies spatially and temporally across the Forest. As ungulate populations ebb and flow, weather and predation influence the amount and distribution of winter kill, and whitebark pine seed production fluctuates from year to year. 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 present seasonally 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. Over a period of 25 years, spring surveys in the Greater Yellowstone Ecosystem showed elk and bison carcasses made up 95 percent of the ungulate carrion used by grizzly bears (van Manen et al. 2018).

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 AB and MHG GAs 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 MHG GA just northwest of Yellowstone National Park, is currently below state population objectives for elk. Likewise, in the BBC GA, 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>).

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 Forest in the Hebgen Basin area near the town of West Yellowstone, Montana. 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, and over 600 bison were counted in the western management zone during the spring of 2019 (Interagency Bison Management Plan 2019). 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), and declined again to 107 animals harvested by state-licensed and Tribal hunters in 2018-2019 (IBMP 2019).

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.), produced an estimate of approximately 292,000 acres of potential bison habitat on the Forest, or roughly 13 percent of the AB and MHG GAs (combined). This relatively simple GIS exercise indicates considerable room for bison expansion on the Forest. Vegetation

baseline data gathered from National Forest System lands in the Gardiner Basin were 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 AB and MHG GAs have a combined grazing capacity to support roughly 1,991 bison year round, or perhaps twice that many bison for only seasonal (winter or spring) use.

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. 2014, Gunther et al. 2014, Ebinger et al 2016, USDI FWS 2016a). A more detailed description of whitebark pine status, condition and trends can be found in the whitebark pine species assessment (candidate species) in this BA. 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). Costello and associates (2014) found that grizzly bears living outside of national parks were more likely to select for secure habitat than for whitebark pine habitat.

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 (Podruzny et al. 2002). In the AB and MHG GAs of the Forest where grizzly bears are currently distributed, over a million acres are at or above 8,200 feet elevation, which provides abundant denning habitat for grizzly bears. Further, much of this habitat is in designated wilderness or areas where terrain limits access for humans. As a result, roughly 94% of the high elevation habitat in the AB and MHG GAs, and by association a considerable proportion of suitable denning habitat for grizzly bears on the Forest, are in secure habitat.

The Interagency Grizzly Bear Committee (IGBC) recognized the impacts of human access on grizzly bear habitat security (IGBC 1994, 1998). Secure areas are a major component of grizzly bear habitat because they provide opportunities for bears to meet energetic demands with low potential for disturbance from human intrusions (USDI FWS 2016a). Secure habitat for grizzly bears in the GYE is defined as those areas at least 4 hectares (10 acres) in size and at least 500 meters (0.3 miles) from open or gated motorized access routes (Schwartz et al. 2010, van Manen et al. 2013, Costello et al. 2014, YES 2016). A key part of the secure habitat definition is distance from an open motorized route. Mattson and associates (1987) found that grizzly bears in Yellowstone National Park consistently used areas within 500 meters of roads less than expected. The ten acre minimum patch size for secure habitat is a reasonably sized area that is useable by an individual grizzly bear, while avoiding disturbance associated with motorized use on roads and trails. The ten acre minimum patch size represents the minimum size area that would be protected by plan components for secure habitat. Had the minimum patch size for secure habitat been much

larger, it would mean that larger patches of secure habitat could be eliminated by road-building in compliance with plan components to maintain secure habitat (F. vanManen, pers. comm. 2016).

Secure habitat is calculated using a suite of GIS geospatial tools collectively referred to as the GYE Motorized Access Model (USDI FWS 2017a), using a database of linear motorized access routes (roads and trails) developed by each administrative unit in the GYE, which are then compiled and maintained by a GYE Grizzly Bear Database Coordinator. While the GYE 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 trails that exist on the ground, but were omitted in mapping for use with the access model). Due to model and database corrections and updates, the reported amount of secure habitat can change over time.

Within the GYE recovery zone for grizzly bears, secure habitat levels are generally 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 (rounded to nearest whole number). Subunits that fall within the Custer Gallatin National Forest boundary are within that range, with a low of 52 percent secure and a high of 100 percent (van Manen et al. 2019). 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. Of the 14 BMU 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. Considering only the Custer Gallatin portion of subunits, the area inside the recovery zone on the Custer Gallatin is roughly 79% secure. Figure 12 shows BMUs and subunits in the GYE.

Secure habitat values for each subunit on the Custer Gallatin are shown in table 20. Secure habitat proportions are presented for baseline conditions in 1998 as well as current levels. 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 (YES 2016). Secure habitat levels have increased in all but two subunits on the Forest since 1998. The two that have not increased have been maintained at over 96 percent secure since 1998. Three subunits: Gallatin 3, Henrys Lake 2 and Madison 2, were identified in early versions of the conservation strategy as in need of improvement relative to 1998 levels. As a result, notable increases in secure habitat have been achieved in these three subunits through implementation of the Gallatin Forest Travel Management Plan. Secure levels achieved at full implementation of the Gallatin travel plan have been formally adopted as new secure habitat baseline levels for the Gallatin 3, Henrys Lake 2 and Madison 2 subunits. In addition, substantial increases in secure habitat from the 1998 baseline have resulted from implementation of the Gallatin travel plan in the Hilgard 1 and 2, and Madison 1 subunits, although 1998 remains the baseline level for these subunits.

Table 20. Secure habitat for Custer Gallatin Bear Management Subunits, 1998 and 2018

Bear Management Subunit Name and Number	Geographic Area	Size Square Miles	Percent Secure 1998 (new baseline)*	Percent Secure 2018	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	55.3 (70.7)	72.5	+17.2
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

Source: van Manen et al. 2019

National Forests in the GYE incorporated habitat management and monitoring recommendations from the Grizzly Bear Conservation Strategy, into forest plans in 2006 (USDA 2006). The basic premise of the Conservation Strategy is that habitat conditions inside the grizzly bear recovery zone should be maintained or improved relative to secure habitat levels, number and capacity of developed sites, and acres of permitted livestock grazing on public lands. Since the Conservation Strategy was first formally adopted into forest plans in 2006, public visitation on federal lands in the GYE has increased dramatically. In Yellowstone National Park alone, annual visitor numbers increased by more than 40 percent from 2008 to 2018, surpassing 4 million visitors annually since 2016 (<https://www.nps.gov/yell/getinvolved/summeruseplanning.htm>). Three of the five entrances to Yellowstone National Park are accessed from the CGNF, which influences visitor use on the Forest. Existing habitat standards in the Conservation Strategy lack flexibility to allow land management agencies to adequately respond to these extraordinary increases of human presence in areas occupied by grizzly bears. As a result of this administrative challenge, federal land managers from the Yellowstone Ecosystem Subcommittee (YES) of the Interagency Grizzly Bear Committee expressed the need to re-evaluate existing habitat standards in the Conservation Strategy, particularly how secure habitat and developed sites are measured, monitored, and restricted (Landenburger 2019 *in* van Manen et al. 2019).

The “Footprint” Approach to Developed Sites – Impacts to Secure Habitat:

The 2016 edition of the Conservation Strategy acknowledged YES managers’ concerns by proposing an interagency review of the 1998 baseline for developed sites, to identify possible solutions for visitor

overflow at existing sites in a manner that does not threaten grizzly bear habitat, and results in minimal departure from the 1998 baseline (YES 2016). As a result, the Interagency Developed Sites Technical Team (Tech Team) was established and tasked with examining alternative scenarios and recommending appropriate changes to the habitat standards and application rules in the Conservation Strategy that would provide added management flexibility to address demands associated with increased public visitation and aging infrastructure. Constraints were imposed on the Tech Team to strike a balance between management needs for accommodating public access and use with habitat protection, while making every attempt to remain true to the original intent of the habitat standards in the Conservation Strategy relative to the 1998 baseline (Landenburger 2019 *in van Manen et al.* 2019). A primary recommendation from the Tech Team was to change the methods for measuring and tracking developed sites within the grizzly bear recovery zone, which led to what is referred to as the “footprint” approach. This new approach changes how larger developed sites are delineated and categorized, and also accounts for measurable impacts on secure grizzly bear habitat due to areas of concentrated human use (Landenburger 2019, unpublished). Different categories of developed sites are discussed further relative to the developed site standard. Here, the intent is to acknowledge the full influence of developed sites on secure habitat for bears.

To accurately reflect human influence associated with developed sites, spatially explicit data pertaining to site infrastructure and motorized access to this infrastructure, was thoroughly reviewed for accuracy. The GYE grizzly bear motorized access GIS database was a crucial part of this review, and in some areas, it was discovered that the database lacked detail, such as small road segments that provide access to individual structures at a given developed site. In such instances, more spatially accurate data were integrated into the motorized access database. Through this review, the accuracy of linear features (roads and trails) in the database was also compared with current and historic aerial photo imagery, with special attention focused near developed sites identified for the footprint approach. Digital motorized route features were spatially aligned where needed to accurately represent georeferenced photo imagery, and routes determined to exist in 1998, but not previously captured in the access database were added. In previous (up through 2016) versions of the Conservation strategy, secure habitat was based solely on proximity to motorized routes. The Tech Team recommendations include revising the definition for secure habitat as “any contiguous area ≥ 10 acres in size and > 500 meters from an open or gated motorized route, recurring low level helicopter flight line, or *perimeter of a prescribed developed site footprint*” (Landenburger 2019, unpublished).

To account for the revised definition of secure habitat, prescribed footprints around selected developed sites are now buffered by an additional 500 meters (approximately 1/3 mile) and the entire area, including the footprint and associated buffer, are subtracted from secure habitat. As a result of this new methodology for measuring impacts of larger developed areas on grizzly bears, and also partly due to improved accuracy of the motorized access database associated with developed sites and surrounding areas, the 1998 baseline, and current values for secure habitat in the GYE have changed slightly. Across the GYE, the collective results of improving the accuracy of linear features and subtracting secure habitat within developed site footprints and associated buffers, have reduced 1998 baseline secure habitat values in some bear management subunits by up to one percent. The relatively minor change in secure habitat is due to the fact that most of the area delineated by the 500 meter buffer around a developed site footprint was previously captured (i.e. detracted from secure habitat) by the 500 meter buffer associated with motorized access routes, both within and outside the developed site footprint (Landenburger 2019, unpublished). Changes in secure habitat for subunits intersecting the Custer

Gallatin range from a 0.4% reduction to a 0.1% increase, with a number of subunits showing no change due to the new method. Reductions in secure habitat are due to the new footprint around some developed sites, improved accuracy (additions) of linear routes, or a combination thereof, whereas the single increase in secure habitat is due to improved accuracy of the linear routes present in 1998 (Landenburger 2019, unpublished). Table 21 shows differences in 1998 baseline secure habitat using the traditional method and the new footprint approach. This table also shows new calculations for full travel plan implementation secure habitat in bear management subunits that intersect the Custer Gallatin National Forest. These new calculations change the (Travel Plan*) baselines for Subunits in need of improvement (relative to 1998), by using the footprint approach. It should be noted that some travel plan implementation has yet to be completed, which accounts for some of the differences between values in table 21 versus table 20 above. For example, some new ATV trail remains to be constructed in the Hilgard 1 subunit. However, most of the differences are due to the new method of calculating secure habitat. Recalculated baseline secure values for all bear management subunits in the GYE can be found in appendix 4 of this BA.

Table 21. Secure Habitat Value Changes Due to Footprint Approach for Developed Sites

BMU Subunit Name	1998 % Secure			Full Travel Plan Implementation % Secure	
	Pre-revision	Post-revision	% change	Post-revision	% change from new 1998 baseline
Boulder/Slough #1	96.6	96.5	-0.1	96.6	+0.1
Boulder/Slough #2	97.7	97.6	-0.1	97.6	0.0
Crandall/Sunlight #1	81.1	81.0	-0.1	81.7	+0.7
Crandall/Sunlight #2	82.3	82.3	0.0	82.7	+0.4
Gallatin #3*	55.3	55.1	-0.2	71.1*	+16.0
Hellroaring/Bear #1	77.0	76.6	-0.4	80.3	+3.7
Hellroaring/Bear #2	99.5	99.5	0.0	99.6	+0.1
Henry's Lake #2*	45.7	45.6	-0.1	52.0*	+6.4
Hilgard #1	69.8	69.5	-0.3	80.5	+11.0
Hilgard #2	71.4	71.5	+0.1	80.1	+8.6
Lamar #1	89.2	89.0	-0.2	89.5	+0.5
Madison #1	71.5	71.5	0.0	80.6	+9.1
Madison #2*	66.5	66.3	-0.2	67.4*	+1.1
Plateau #1	68.8	68.6	-0.2	70.6	+2.0

Source: Landenburger 2019, unpublished

* New baseline adopted at full Travel Plan implementation

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 (BAU) and reported every 2 years in even years, so 2018 is the most current year reported. Unlike BMUs, the BAUs on the Custer Gallatin are wholly within the Forest boundary (i.e. not shared with other administrative units). The footprint approach to tracking larger developed sites does not affect secure

habitat outside the recovery zone. In 2018, secure habitat outside the recovery zone averaged about 65% across the entire GYE (Landenburger *in van Manen et al.* 2019). This amount indicates about a 2 percent increase in secure habitat outside the recovery zone since 2008, which is the first year there was a reliable dataset for motorized access outside the recovery zone (Ibid 2017). Accuracy of road and trail data improved during this time on the Custer Gallatin, due to a comprehensive review associated with travel management planning. By comparison, secure habitat averaged about 71 percent across all BAUs on the Forest in 2018 (Ibid 2019, Landenburger 2019, pers. comm.), which is about a 5 percent increase since 2008. Figure 13 shows the location of BAUs in the GYE, and table 22 shows secure habitat for each Custer Gallatin BAU for the years 2008 and 2018.

Table 22. Secure habitat in Custer Gallatin Bear Analysis Units in 2008 and 2018

Bear Analysis Unit	Revised Plan Geographic Area	Square Miles	Percent Secure 2008	Percent Secure 2018	Change
Boulder	Absaroka Beartooth	278	64.8	69.7	+4.9
Bozeman	Madison, Henrys Lake, and Gallatin	271	45.6	59.3	+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	67.9	+10.7
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
Total	Montane Ecosystem	2,666	65.7	70.8	+5.1

Sources: van Manen et al. 2017, 2019; Landenburger 2019 pers. comm.

Prior to combining, both the Custer and Gallatin Forests went through comprehensive travel management planning processes that examined all forms of travel (public and administrative use) and included consideration of future needs for travel infrastructure. 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, both within and outside the recovery zone (as shown in table 21 and table 22 above), are largely due to implementation of these travel management plans.

Bear Management Subunits and Bear Analysis Units provide appropriate scales of analysis for project-level effects, and have informed the analysis of programmatic direction prescribed in the revised plan. Additionally, 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 currently present in the AB and MHG GA. The BBC GA is not currently occupied by grizzlies, and is outside of the Greater Yellowstone Ecosystem grizzly bear distinct population segment (USDI FWS

2016a). However, the BBC GA 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. Combined, these geographic areas are currently about 74 percent secure habitat. Figure 14 and table 23 show proportions and distribution of secure habitat for grizzly bears by geographic area.

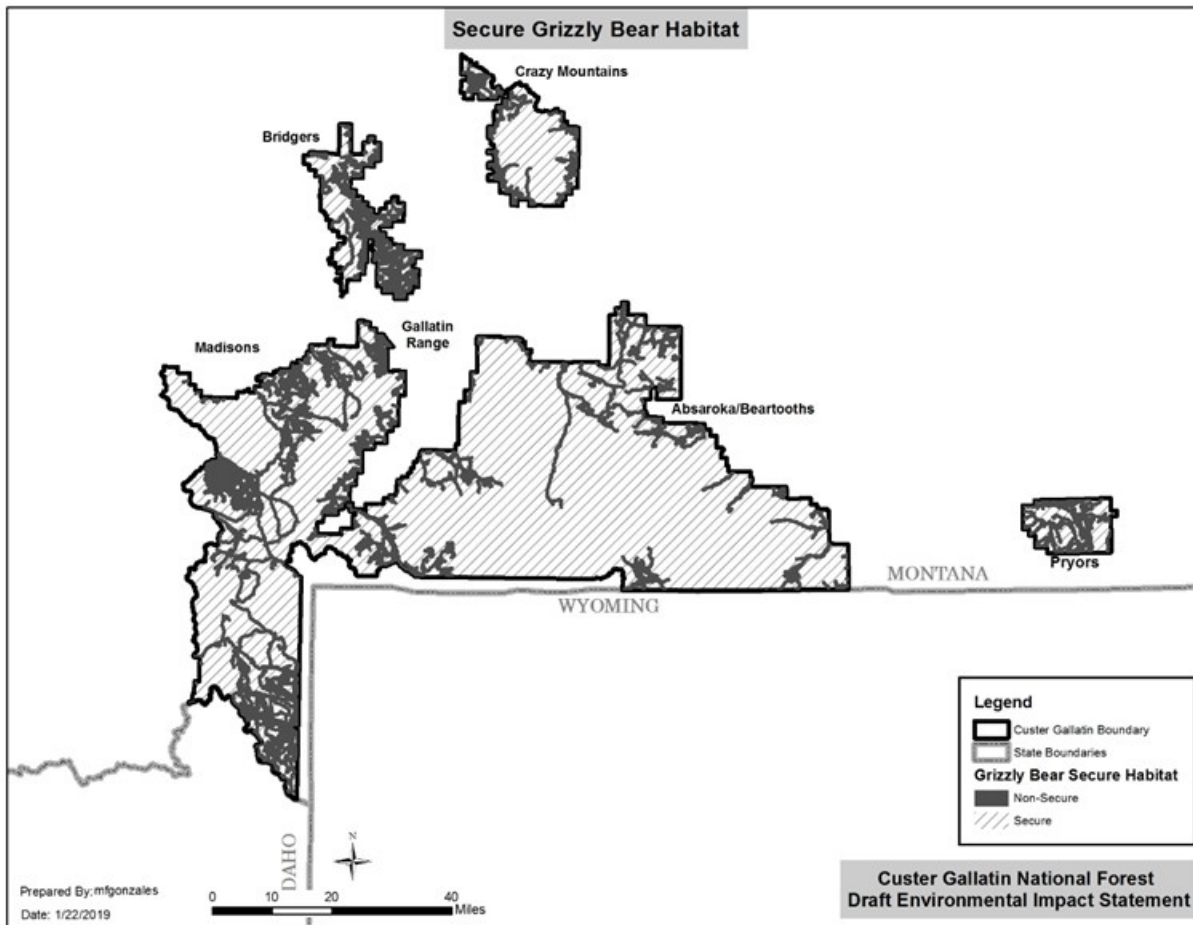


Figure 14. Grizzly bear secure habitat on the Custer Gallatin National Forest

Table 23. Secure habitat in the Custer Gallatin Montane Ecosystem Geography Area

Geographic Area	Size in Square Miles	Percent Secure as of 2019
Absaroka Beartooth Mountains	2,167	86.2
Madison, Henrys Lake, Gallatin Mountains	1,488	62.2
Bridger, Bangtail, Crazy Mountains	491	53.7
Total (GAs combined)	4,146	73.8

In addition to secure habitat related to motorized human access, 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 GAs within the montane ecosystem on the Forest (even those currently unoccupied by grizzlies) are under a special order (#01-14-11-00-02) that requires food and other human-related attractants to be properly stored so that they are unavailable to bears.

As with secure habitat, the year 1998 is used as a baseline for monitoring the number, distribution, and impacts associated with developed sites inside the recovery zone. Developed sites include areas on NFS lands that have permanent structures and facilities intended to accommodate public recreational use or administrative needs, or both. Examples include, but are not limited to campgrounds, picnic areas, trailheads, recreational residences and rental cabins. As mentioned previously, visitor use in the GYE (including areas of the Custer Gallatin) has increased dramatically since 1998, resulting in increased demand for developed site facilities, and a subsequent request from the Yellowstone Ecosystem Subcommittee (YES) to re-evaluate how larger developed sites in the GYE are measured and tracked over time for changes relative to 1998 (YES, 2016, vanManen et al. 2019). An Interagency Developed Sites Technical Team (Tech Team) was appointed by the YES to examine the issue and make recommendations for changes back to the subcommittee. The processes employed by the Tech Team and resulting recommendations for changes were documented in a technical report (Landenburger 2019, unpublished). Once the recommendations are approved by the subcommittee, the new approach for managing developed sites and monitoring associated impacts on grizzly bear habitat, will be officially incorporated into the Conservation Strategy, with information from the technical report (ibid) included in an appendix.

At the request of the Yellowstone Ecosystem Subcommittee, the Tech Team recommended using a “footprint approach” for delineating areas around larger developed sites inside the recovery zone, typically encapsulating all motorized access routes to, from and within the developed areas, as well as other associated infrastructure; e.g. buildings, utilities, etc. As described previously, the entire footprint was then buffered by 500 meters to capture the zone of influence associated with human use, and the entire acreage was detracted from secure habitat. Developed sites that warrant the footprint approach include extensively developed areas with permanent infrastructure designed to accommodate relatively high levels of concentrated public and/or administrative use, as well as areas identified by GYE managers as having the greatest need for added infrastructure to address the administrative difficulties resulting from increased, and often uncontrolled visitor use on public lands (Landenburger 2019, unpublished). The Tech Team identified four different categories for prescribed footprints:

Administrative facilities used primarily by government employees and/or authorized agents (e.g. contractors, permittees), for the purpose of managing public lands and associated resources.

Visitor Overnight sights comprised of multiple building units to accommodate commercial overnight visitor use, as authorized under special use permit.

Front-country, developed **Campgrounds**, with road access and associated infrastructure; e.g. paved parking pads, picnic areas, fire grates, restrooms, etc.

Major Developments characterized by expansive commercial, residential, administrative and recreational development located on National Park lands, designed to host a complex combination of administrative and public use.

Of these categories of developed sites, the Custer Gallatin currently hosts seventeen administrative sites, sixteen front-country developed campgrounds, and two visitor overnight lodges that operate under special use permit. All of these developments were in place in 1998, and most were operating in a similar capacity as currently. The two exceptions include the OTO administrative site (Hellroaring/Bear 1), and the Chief Joseph Campground (Crandall/Sunlight 1). The Forest Service acquired the OTO Tract in 1991 as part of the Northern Yellowstone Winter Range Acquisition Project. Prior to that acquisition the OTO was an historic, privately-owned dude ranch dating back to the 1800s. From the time of Forest Service acquisition to the early 2000s, management activities at the OTO focused on historic preservation, but also provided administrative housing to agency personnel. Current use levels at the OTO are similar to those occurring during the preservation efforts, including approximately three weeks of overnight use and four weeks of day use in summer months, in addition to providing year-round housing for administrative personnel.

The Chief Joseph Campground (Crandall/Sunlight 1) was in place and operating at full capacity in 1998, but was closed in 2017, due in part to a grizzly bear mauling resulting in human fatality that occurred in the nearby Soda Butte campground in 2010. Following this event, Custer Gallatin campgrounds in the vicinity were limited to hard-sided camping only. With this change, the campgrounds saw a decrease in use. The Chief Joseph campground was relatively small at just six sites, and costs associated with campground maintenance for this unit could no longer be justified. Finally, it should be noted that the Beaver Creek Campground (Madison 2) is almost entirely located outside the recovery zone, but a small part of the footprint and associated buffer now enter the recovery zone. Table 24 shows the number, type, and location (Subunit) of developed sites converted to the footprint approach on the Custer Gallatin. Figure 15 shows locations of new footprints and primary roads inside the recovery zone.

Table 24. Custer Gallatin Larger Developed Sites with Footprint Inside the Recovery Zone

AB GA Subunits	Administrative	Campground	Overnight Lodge	Total
Boulder/Slough 1	0	1	0	1
Boulder/Slough 2	0	0	0	0
Crandall/Sunlight 1	0	*1	0	1
Crandall/Sunlight 2	0	0	0	0
Hellroaring/Bear 1	5	4	0	9
Hellroaring/Bear 2	0	0	0	0
Lamar 1	4	2	0	6
MHG GA Subunits				
Gallatin 3	1	2	0	3
Henry's Lake 2	0	3	0	3
Hilgard 1	0	0	1	1
Hilgard 2	0	0	0	0
Madison 1	1	*1	0	2
Madison 2	6	2	1	9

Plateau 1	0	0	0	0
Totals	17	16	2	35

* Chief Joseph Campground (Crandall/Sunlight 1) is currently closed; Beaver Creek campground (Madison 2) is outside of recovery zone – only part of footprint enters recovery zone.

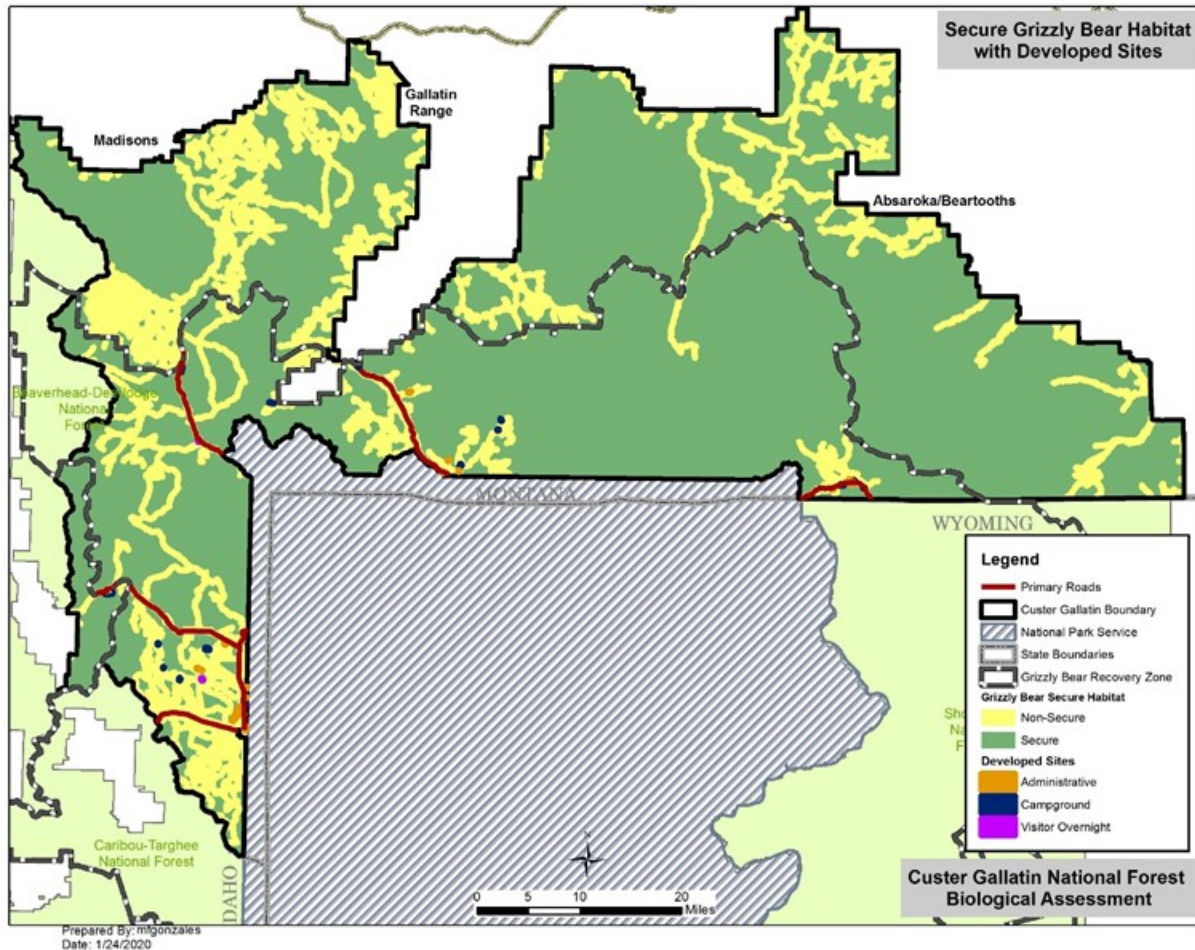


Figure 15. Secure habitat relative to motorized routes, developed site footprints, and primary roads

Smaller sites (e.g. trailheads, backcountry cabins, etc.) are still treated as points rather than polygons, and do not detract from secure habitat other than the reduction associated with motorized access routes. The total number of developed sites, including both polygons (footprints) and points inside the recovery zone on the Custer Gallatin National Forest has dropped from 183 in 1998 to 177 in 2018 (van Manen et al. 2019). Developed sites were originally tracked at least in part, due to grizzly bear mortality risk associated with human foods and other attractants that can draw grizzly bears into conflict situations. There have been very few human-caused grizzly bear mortalities associated with developed sites on the Custer Gallatin National Forest. The most recent occurred in 2010, when a food-conditioned female grizzly and three yearlings were removed after causing a human fatality and injuries at a developed campground. While mortalities are rare, a few bear-human conflicts (without injuries or fatalities to bears or humans) still occasionally occur at or near developed sites on the Forest.

Grazing of domestic livestock is another factor that can affect grizzly bears, in that grizzly bears are known to occasionally depredate on domestic grazing animals such as cattle or sheep. Such conflicts between grizzly bears and domestic livestock can result in the capture, relocation, injury, or removal of grizzly bears. Accordingly, the number and acreage of domestic livestock grazing allotments permitted within the grizzly bear recovery zone is tracked over time, as are grizzly bear conflicts with livestock on these allotments, including the outcome; i.e. whether the conflict resulted in mortality of the bear (van Manen et al. 2019).

In the AB and MHG GAs combined, where grizzly bears are known to occur, there are currently 65 active and 17 vacant livestock grazing allotments. Of those, 14 active and 5 vacant allotments are located within the grizzly bear recovery zone. The number of domestic livestock allotments on the Custer Gallatin inside the recovery zone has declined from 39 in 1998 to 19 in 2019, and total acreage utilized by permitted livestock has declined by more than 70 percent. In 1998, active and vacant livestock allotments were present on more than 26 percent of the area inside the recovery zone. By contrast, active and vacant allotments currently occur on 7 percent of the area inside the recovery zone. This reduction included the permanent elimination of two active and four vacant sheep allotments. Outside the recovery zone, active and vacant livestock allotments are present on about 19 percent of the area within the current distribution of grizzly bears on the Custer Gallatin. There are currently no sheep grazing allotments on the Custer Gallatin National Forest, inside or outside the recovery zone. Table 25 shows numbers and acreage of permitted livestock grazing allotments in the AB and MHG GAs, where grizzly bears are known to occur.

Table 25. Number, Acreage, and Types of Livestock Grazing Allotments

Allotment Type	Inside Recovery Zone ¹				Outside Recovery Zone	
	1998 #	Acres	2019 #	Acres	2019 #	Acres
Active Cattle/Horse	23	91,157	14	57,252	51	223,482
Vacant Cattle/Horse	10	46,422	5	17,040	12	29,324
Active Sheep	2	91,570	0	0	0	0
Vacant Sheep	4	42,716	0	0	0	0
Totals	39	271,865	19	74,292	63	252,716

¹Numbers inside recovery zone from van Manen et al. 2019; Acres inside recovery zone calculated by Lisa Landenburger 2019.

There have been a few livestock (cattle) depredations attributed to grizzly bears on the Custer Gallatin in recent years. Depredations occurred in 2016 and 2017 on the Wigwam allotment located north of Yellowstone National Park (see Figure 16). These were isolated incidents that neither led to recurring conflicts (defined as having occurred in three out of five preceding years), nor resulted in grizzly bear mortalities (van Manen et al. 2018). There were no grizzly bear-livestock conflicts reported on any Custer Gallatin grazing allotments in 2018 (Ibid 2019).

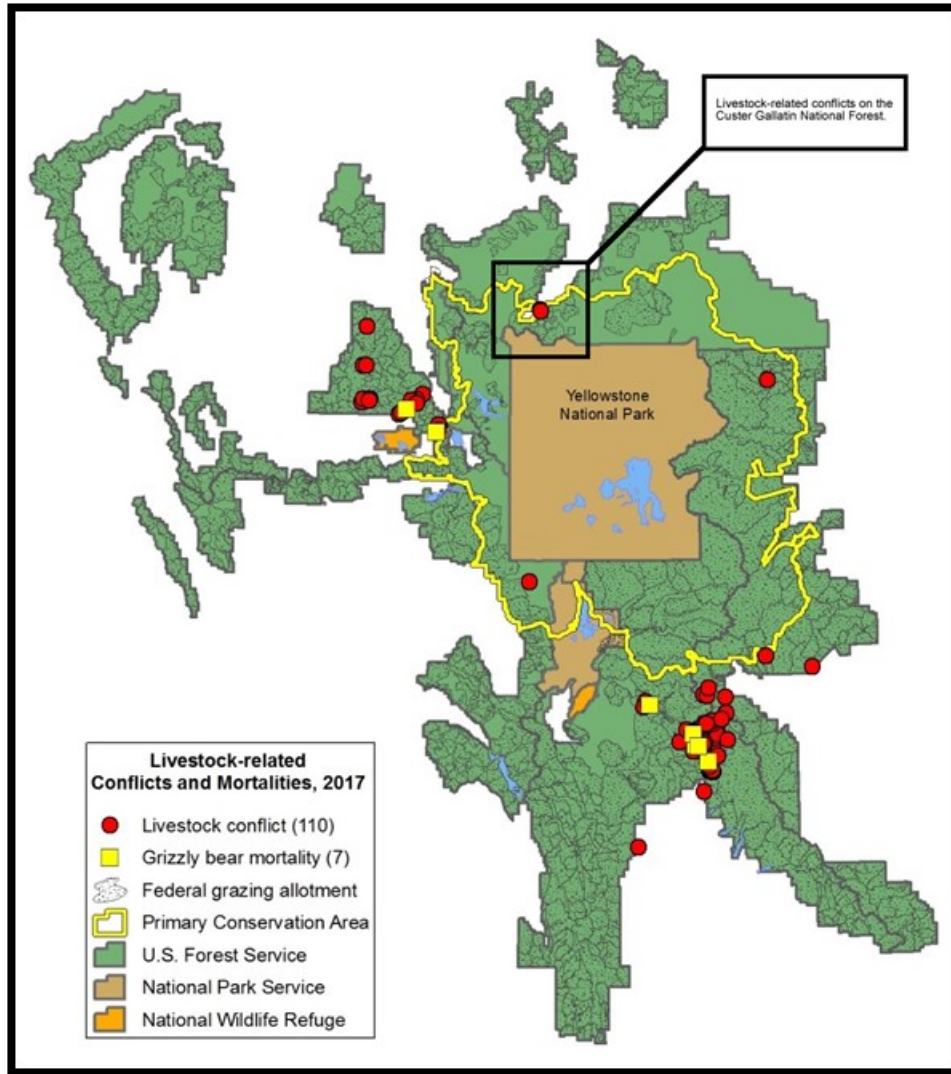


Figure 16. Livestock Allotments & Associated Grizzly Bear Mortalities 2017 {Van Manen, 2018 #12058}

A Special Order requiring the proper storage of food and attractants has been in place on the Forest within the recovery zone since the mid-1980s. The Food Storage Order was expanded to cover the entire montane ecosystem of the Forest in 2007, and now covers an area substantially beyond the current known grizzly bear distribution on the Forest. Food and attractants include human food, pet food, livestock feed, scented personal hygiene products, and animal carcasses of domestic livestock or human-killed fish and wildlife. The Food Storage Order requires that all such substances, when not attended, must be acceptably stored, by a variety of means, so that they are made unavailable to bears. In the case of animal carcasses, these attractants must be acceptably stored or an acceptable distance from camping/sleeping areas and Forest System trails. This mechanism for improving human sanitation and reducing availability of unnatural foods for bears, combined with maintaining or increasing secure habitat and maintaining or reducing developed sites and livestock grazing allotments have worked collectively to allow for grizzly bear expansion into suitable habitats and reduced potential for human-caused grizzly bear mortality on the Custer Gallatin Forest over time.

In the Montana portion of the GYE, which includes the Custer Gallatin, Frey and Smith (*in vanManen et al. 2019*) noted that sanitation efforts (e.g. food storage order) 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 20 percent increase in grizzly bear-human conflicts in the Montana portion of the GYE during the most recent decade (2009-2018) compared to the previous decade (1999-2008), 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. Grizzly bear-human conflicts on the Custer Gallatin have followed similar trends.

While the number of grizzly bear-human conflicts in the Montana portion of the GYE has increased over time, the long-term grizzly bear mortality trend due to human causes has remained relatively stable, with an average (known or probable) loss of 5.4 grizzly bears per year. Although the numbers of human-caused grizzly bear deaths have remained fairly constant, the causes and locations of grizzly bear mortalities have changed over time. Grizzly bear mortalities during the first decade of the 21st century were primarily associated with bears seeking and/or obtaining unnatural foods from human sources on public and private lands. Human-caused grizzly bear mortalities in the past decade have been primarily related to front and backcountry surprise encounters, mainly on public lands, as well as livestock depredations occurring on private and public lands, many of which occurred outside the demographic monitoring area for GYE grizzly bears (Frey and Smith *in van Manen et al. 2019*).

The number of known and probable human-caused grizzly bear mortalities on the Custer Gallatin have also remained fairly constant over time, averaging about 2 per year, which is roughly 37 percent of the average annual human-caused grizzly bear mortalities in the Montana portion of the GYE demographic monitoring area. However, the Custer Gallatin administers nearly 62 percent of the land within that same area. As with other areas of the GYE, a change in cause of grizzly bear mortalities has been evident on the Custer Gallatin. Whereas human-caused mortalities early in the 21st century were primarily associated with grizzly bear attraction to anthropogenic food sources, within the past decade, grizzly bear mortalities on the Custer Gallatin have been primarily associated with backcountry encounters with hunters, either through mistaken identity by black bear hunters, or more frequently, by big game hunters defending themselves during encounters with grizzly bears. Table 26 shows the number and cause of grizzly bear conflicts and human-caused mortalities on the Custer Gallatin over the past decade.

Table 26. Grizzly Bear Conflicts and Mortalities (known and probable) – 2009-2018

Year	# Conflicts	Main Conflict Cause	# Human-caused Grizzly Mortalities	Mortality Cause(s)
2009	5	Surprise encounters	2	Hunting; self-defense
2010	3	Surprise encounters	6	Hunting; Mgt removal ¹
2011	10	Unnatural foods Property damage	0	No grizzly bear mortalities on CGNF
2012	13	Surprise encounters	0	No human-caused grizzly mortalities on CGNF
2013	6	Surprise encounters	2	Vehicle strikes
2014	9	Surprise encounters	1	Illegal shooting

2015	6	Surprise encounters	1	Mgt. removal ²
2016	5	Surprise encounters Livestock depredation	1	Vehicle strike
2017	13	Surprise encounters Livestock depredation	6	Hunting ³
2018	9	Surprise encounters Unnatural foods	1	Hunting encounter
Ave over 10-yr period	8/yr		2/yr	Primary cause: hunting

Source: Interagency Grizzly Bear Study Team Annual Reports (2009-2018)

¹Management removals in 2010 included a female and three cubs involved in human fatality

²2015 mortality resulted from a management action in which a family of grizzlies depredating on livestock elsewhere in the GYE were relocated on the CGNF, where a cub subsequently was lost.

³Hunting-related mortalities in 2017 included one mistaken identity for black bear; others were all in defense of life, including loss of a female with three cubs of the year.

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. The BBC GA, which is currently unoccupied by grizzly bears, has good potential to provide habitat connectivity for grizzly bear movement (Walker and Craighead 1997, Cushman et al. 2009, Peck et al. 2017). Part of this GA, the Bridger and Bangtail Ranges, are identified in the Northern Continental Divide Ecosystem Grizzly Bear Conservation Strategy (NCDE 2018) as Management Zone 2, which indicates areas to be managed for opportunistic movement of grizzly bears between ecosystems. Notably, the Bridger and Bangtail Mountains are isolated ranges, separated from each other by Montana Highway 89, and separated from larger, contiguous mountainous/forested lands by Interstate 90, a number of state highways, and large areas of private land, which all affect connectivity. The Bridger Mountain Range has generous patches of inventoried roadless areas, which provide secure habitat, as well as well as forage and cover options for bears. However, other than these inventoried roadless areas and a 3,300 acre special interest area in the Bangtails, there are currently no other designations or land use allocations in the Bridger/Bangtail Range that restrict management actions. As a result, outside of inventoried roadless areas, there are a number of areas where road densities exceed 2 miles per square mile in the Bridger and Bangtail ranges. Like the rest of the montane ecosystem, the entire BBC GA is under a special order for attractant storage.

Factors affecting grizzly bears

Interactions with people are by far the leading factor affecting the Greater Yellowstone Ecosystem grizzly bear population (Schwartz et al. 2010, USDI FWS 2016a). The same likely holds true for grizzly bears that inhabit or pass through the Custer Gallatin National Forest. The Interagency Grizzly Bear Committee (1994, 1998) recognized the impacts of human access on grizzly bear habitat. Specifically, motorized vehicle access has been shown to increase human interactions 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. Motorized access routes (roads and trails) and areas of concentrated human use (developed site footprints) detract from secure habitat. Permitted livestock grazing allotments contain live animals, livestock feed and supplements, and occasionally livestock carcasses, any of which 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 from otherwise suitable habitat, 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 individually and collectively influence grizzly bear survival, reproductive success, and distribution.

Effects of the proposed action on factors affecting grizzly bears in the action area

In addition to the Forest-wide multi-disciplinary, coarse-filter plan components developed for a variety of resource areas, the revised plan contains a suite of fine-filter plan components designed specifically to protect grizzly bears and their habitat. Plan components for grizzly bear were adopted from, or are complementary to, grizzly bear habitat management recommendations contained in the Conservation Strategy for Grizzly Bears in the Greater Yellowstone Ecosystem (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.

The revised plan includes a desired condition for habitat that contributes to all T&E species recovery, and for stable to increasing population trends for listed species (FW-DC-WL 02). Specifically, the plan states that grizzly bears, including reproductive females, are present and well distributed within the recovery zone, and also that grizzly bears occur where habitat is biologically suitable and their presence is socially acceptable outside the recovery zone (FW-DC-WLGB 01, 02). Further, the plan contains a desired condition that secure habitat outside the recovery zone contributes to habitat connectivity and facilitates grizzly bear movement between ecosystems (FW-DC-WLGB 02), with a goal to ultimately achieve successful dispersal of grizzly bears between ecosystems (FW-GO-WLGB 01). In addition to grizzly bear-specific plan components, the revised plan contains desired conditions for vegetative patterns that are generally within the natural range of variation to provide habitat diversity for assorted life cycle needs, as well as general conditions that provide security and refuge for wildlife to escape from all manner of stresses and threats (FW-DC-WL 03, 04). In that regard, the plan contains a desired condition that human-related foods and attractants are unavailable to wildlife, and associated conflicts are avoided (FW-DC-WL 08). These specific and detailed desired conditions reflect changing attitudes, circumstances, and environmental conditions, as well as increased grizzly bear numbers and distribution on the Forest, relative to existing plans.

Collectively, the desired conditions spelled out in the revised plan affirm the intent to proactively manage habitat and human activities to support continued grizzly bear expansion and use of CGNF habitats, while also providing for human safety. These plan components 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 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.

Under the revised plan, the portion of the Forest within the grizzly bear recovery zone would be managed using concepts outlined in the Greater Yellowstone Ecosystem grizzly bear conservation strategy (YES 2016). Plan components would apply equally to both the Custer and Gallatin portions of the national forest, bringing greater consistency to management of habitat within the Custer Gallatin, as well as ensuring consistency with grizzly bear habitat management on other public lands in the Greater Yellowstone Ecosystem. 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 revised plan formally adopts habitat management recommendations from the conservation strategy, with the overall intent to maintain or improve grizzly bear habitat inside the recovery zone relative to 1998 conditions so that human-related disturbances and/or bear mortalities can be limited, while maintaining options for resource management activities both inside and outside the recovery zone. Incorporating grizzly bear habitat and conflict monitoring items allow the Forest, in cooperation with other agencies, to respond to demonstrated issues with appropriate management actions. This strategy is consistent with the Grizzly Bear Recovery Plan as amended (USDI 1993), which acknowledges that lands outside the recovery zone will be managed with more consideration for human uses.

Management practices outlined in the conservation strategy have been implemented under existing plan direction to some degree, as well as under interagency agreements, with demonstrated effectiveness in reducing bear-human conflicts and allowing for expansion of grizzly bear distribution across the Custer Gallatin National Forest, both inside and outside the recovery zone. The conservation strategy focuses habitat management recommendations on addressing three primary threats to grizzly bears: availability of secure habitat, presence of domestic livestock, and human use associated with developed sites, as well as establishes monitoring protocols for primary food sources.

Secure Habitat

Grizzly bear habitat standards (FW-STD-WLGB 01-03) would maintain proportions of secure habitat inside the recovery zone at or above levels present in 1998 as revised using the “footprint approach”, with increased baselines for the Gallatin 3, Madison 2 and Henrys Lake 2 bear management subunits, which were identified as in need of improvement from 1998 conditions in the conservation strategy. The new baseline for secure habitat in these three subunits was achieved through implementation of the 2006 Gallatin Travel Management Plan. Aside from these three subunits, secure habitat (using the footprint approach) has increased over 1998 baseline levels in ten additional subunits, and stayed the same in the one remaining subunit that intersects the Forest boundary (refer to table 21). Under the revised plan, management actions could be implemented that would temporarily or permanently reduce secure habitat in subunits that are currently above baseline levels. In such cases, it is likely 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).

Consistent with the Conservation Strategy, the revised forest plan would allow for permanent changes in configuration of secure habitat inside the recovery zone, but losses of secure habitat below established baseline levels must be replaced with commensurate secure habitat elsewhere in the same bear management subunit or in the nearest subunit possible. The revised plan accomplishes this by

formally adopting the secure habitat standard, and associated application rules from the conservation strategy. Resulting plan components include requirements for consideration of habitat quality and quantity when replacement secure habitat is needed. Further, replacement habitat must be in place before project implementation results in a reduction of secure habitat below baseline levels, and must be in place for a minimum of ten years, which is the approximate generation time of a reproductive female grizzly, or the time it takes to replace herself in the population. This condition is intended to give affected grizzly bears time to adapt to changing conditions.

An additional standard has been added based on recommended changes to the conservation strategy, which acknowledges the need for occasional emergency repairs to existing infrastructure due to natural events such as landslides. Emergency repairs that require substantial relocation of facilities could impact secure habitat. Under the revised plan, such repairs must be made in the nearest suitable location to damaged facilities when replacement within the existing alignment is not feasible. If such realignment results in a reduction of secure habitat below baseline levels, a commensurate level of secure habitat must be replaced elsewhere within the affected subunit or the nearest available subunit, to meet the intent of the secure habitat standard. With 10 of the 14 subunits intersecting the Custer Gallatin currently above baseline levels for secure habitat, the added standard requiring replacement locations to be within or near existing facility alignment further reduces the risk of dropping below baseline secure habitat levels due to emergency repairs of forest infrastructure.

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 (FW-STD-WLGB 03). Additional restrictions would limit the number of projects so that only one project (regardless of administrative jurisdiction) could temporarily reduce secure habitat below baseline levels within any subunit at the same time. Further, plan components would restrict the purpose for projects that temporarily reduce secure habitat below baseline levels to administrative use, and limit the duration of associated reductions in secure habitat to no more than 4 consecutive years, including project implementation as well as decommissioning activities needed to close temporary roads upon project completion. Finally, management actions that result in temporary reductions in secure habitat below baseline, would be concentrated in time and space so as to minimize disturbance effects on grizzly bears in the project vicinity (FW-GDL-WLGB 01).

Temporary reductions in secure habitat inside the recovery zone could potentially have adverse impacts on individual bears residing in the project vicinity, due to disturbance factors that could alter behavior patterns and/or result in displacement of bears from suitable habitat. However, the secure habitat plan components are derived from application rules in the conservation strategy that are intended to allow for some level of management flexibility, while simultaneously maintaining adequate proportions of secure habitat at the subunit level to allow options for bears disturbed or displaced by management actions to find refuge elsewhere within a bear management unit or subunit. Based on recent expansions in grizzly bear distribution, and slowing of grizzly bear population growth in recent years, van Manen and associates (2013) have suggested that the Greater Yellowstone Ecosystem grizzly bear population may be nearing carrying capacity. If grizzly bear habitat on the Custer Gallatin is at or near carrying capacity, then individual bears displaced by management actions, even temporarily, could experience additional impacts due to conflicts with other bears in the vicinity.

Outside the recovery zone secure habitat is measured by proximity to motorized routes and monitored for changes over time. There are no plan components specifically related to grizzly bears that would

prevent reductions in secure habitat outside the recovery zone from future management actions on NFS lands. However, there are a variety of other factors that would limit secure habitat reductions outside the recovery zone. Forty-four percent of NFS lands in the AB and MHG GAs outside the recovery zone are within designated wilderness, where no further reductions in secure habitat could occur under established wilderness management laws. Another 33 percent of NFS lands in the AB and MHG GAs outside the recovery zone are currently within a wilderness study area designated by Congress or inventoried roadless areas, which also come with land use restrictions that limit road construction, and thus protect secure habitat. In addition to land use restrictions in designated areas, new land use allocations in the revised plan would establish long-term management direction in some portions of the wilderness study area and inventoried roadless areas, as well as some portions of the Forest with no existing Congressional designations. New land use allocations for recommended wilderness areas, backcountry areas and key linkage areas in the revised plan would limit further reductions in secure habitat outside the grizzly bear recovery zone. No new roads (permanent or temporary) would be constructed in recommended wilderness or backcountry areas in the AB or MHG GAs. Permanent or temporary roads could be constructed within the key linkage area, but only for resource management, with duration limits applied (FW-GDL-WL 03-05).

There is considerable overlap between designated areas (wilderness study area, inventoried roadless areas) and new forest plan allocations for recommended wilderness, backcountry areas and key linkage areas. Inside the recovery zone, new forest plan allocations add land use restrictions to just a few thousand acres not already protected by Congressional designations, and therefore do not notably change the overall proportion of protected lands within the recovery zone. Secure habitat standards in the revised plan would maintain secure habitat levels at or above baseline levels inside the recovery zone. Outside the recovery zone where there are no secure habitat standards for grizzly bears, forest plan allocations increase the amount of protected area by nearly 30,000 acres, thereby slightly increasing the proportion of area protected area outside the recovery zone. Table 27 shows various land designations and forest plan allocations for the current condition and what would be protected under the revised plan. To account for overlap, the figures in Table 27 do not represent the total acreage in all categories (except for designated wilderness) so as not to over-represent the proportions of protected areas that contribute to habitat security for grizzly bears.

Table 27. Percent of land use designations and allocations in grizzly bear distribution area

Existing Condition: AB+MHG GAs – NFS Lands			
	Inside Recov Zone	Outside Recov Zone	Total
Designated Wilderness	54%	44%	48%
Wilderness Study Area	6%	7%	7%
Inventoried Roadless	22%	24%	23%
Recommended Wilderness ¹	<1%	2%	1%
Totals	82%	77%	79%
Revised Plan: AB+MHG GAs – NFS Lands			
	Inside Recov Zone	Outside Recov Zone	Total
Designated Wilderness	54%	44%	48%
Recommended Wilderness	5%	4%	5%
Backcountry Area	3%	7%	5%
Wilderness Study Area	<1%	2%	1%
Inventoried Roadless	20%	22%	21%

Key Linkage Area	0	<1%	<1%
Totals	82%	79%	81%

¹Existing Recommended Wilderness Areas are also Inventoried Roadless – acres counted separately.

In addition to grizzly bear-specific direction and new forest plan allocations, there are other plan components that would further limit impacts to secure habitat both inside and outside the recovery zone. These include direction to manage secure habitat for big game species (FW-GDL-WLGB 03) and direction to avoid building new permanent or temporary roads in riparian management zones (FW-GDL-RMZ 03). The revised plan also indicates recreational aircraft landing and take-off would only be allowed at designated sites (FW-STD-AIRFIELDS 01), and that the grizzly bear recovery zone is not suitable for designated aircraft landing/takeoff strips (FW-SUIT-AIRFIELDS 01). These provisions would preclude added disturbance to grizzly bears associated with aircraft use by the general public inside the recovery zone. Grizzly bear plan components would allow landing and takeoff of aircraft (helicopters) inside the recovery zone for administrative use, but would limit such use for planned project implementation to no more than two days per project. Helicopter use for emergency response would be allowed as needed (WL-SUIT-WLGB 01). Occasional helicopter use for administrative purposes could have negative impacts on individual bears, but such impacts would be limited by plan direction and therefore effects would be temporary.

The revised plan also adds a new guideline for recreation events (FW-GDL-RECEVENT 02) that would prevent authorization of recreation events involving people traveling by foot, horse or non-motorized vehicle inside the recovery zone between sundown and sunrise. Nighttime recreation events would also be prohibited in key linkage areas outside the recovery zone (FW-STD-WL 02). These provisions were added to minimize potential for surprise encounters with grizzly bears associated with humans moving quietly through core grizzly bear habitat at night, as well as to increase temporal options for grizzly bears to utilize secure dispersal routes.

Collectively, grizzly bear-specific direction plus direction for other resources, will maintain secure habitat inside the recovery zone at or above applicable baseline levels displayed in table 21 above. Again, there are no specific plan components that would preclude reductions in secure habitat outside the recovery zone. However, given the variety of restrictions on new motorized uses for other resource reasons outside the recovery zone, it is reasonable to expect that future reductions in secure habitat outside the recovery zone over the life of the plan would be minor. We estimate that permanent reductions in secure habitat due to Forest Service management actions would not exceed 1% below full travel plan implementation for any BAU, and that total reductions (due to new permanent and temporary motorized routes combined) would not exceed 2% below full travel plan implementation (as presented in table 22 above) for any BAU on the Custer Gallatin National Forest over the life of the revised plan.

Under the revised plan monitoring requirements, secure habitat inside the recovery zone would continue to be measured and reported annually, with any new temporary or permanent motorized routes added to the motorized access database. Secure habitat would continue to be monitored and reported every two years outside the recovery zone, again by incorporating any new temporary and permanent motorized access routes on NFS lands. During Forest Travel Management planning efforts in the early 2000s, the motorized access database for the Custer and Gallatin Forests came under close scrutiny, and consequently, the accuracy of the linear database used to calculate secure habitat inside and outside the recovery zone, was improved considerably. As mentioned above, this database was again closely reviewed by the CGNF personnel in coordination with the Yellowstone Ecosystem

Subcommittee Technical Team that recently revised conservation strategy recommendations for developed sites and related habitat security, improving the accuracy of the database even more.

Forest Travel Plan decisions for the Custer Gallatin designate routes where various modes of travel (motorized, mechanized, and livestock) are allowed or prohibited, and any seasonal restrictions that apply. Travel Plans that apply to the areas where grizzly bears may be present (Gallatin Travel Plan 2006, Beartooth Ranger District Plan 2008) include standards that preclude wheeled motorized vehicle travel off of designated routes with certain exceptions for emergencies and occasional administrative use. The travel plans also include an exception that allows vehicle travel up to 300 feet off of a designated road or trail for the sole purpose of accessing dispersed camp sites, unless specifically prohibited, or unless such use would result in damage or unreasonable disturbance to land, wildlife or vegetative resources. The 300 foot general allowance does not apply in high use areas such as the west shoreline of Hebgen Lake, along the Gallatin River, the Taylor Fork Road, the Beaver Creek Road, the Hyalite Road, the Main Boulder Road, the Mill Creek Road, the Beartooth Highway (212), and in Bear Canyon. In these sites, dispersed campsites have been designated (Ibid).

To implement the Travel Plans, motor vehicle use maps (MVUM) identify those roads, trails and areas designated for motor vehicle use under 36 CFR 212.51. These designation apply only to roads, trails, and areas on National Forest System lands. It is prohibited to possess or operate a motor vehicle on National Forest System lands on the Custer Gallatin National Forest other than in accordance with these designations. It is the responsibility of the user to acquire the current MVUM. Monitoring the effectiveness of the Travel Plans and MVUM is an ongoing task. Custer Gallatin personnel annually review the MVUMs for needed implementation updates or corrections. The Forest hires field Rangers to evaluate and correct issues, and to educate users. Law Enforcement Officers (LEOs) are available for legal enforcement, and resources are made available to assist in correcting issues, such as physically closing newly established unauthorized routes. Based on field observations, enforcement issues and professional opinion, Custer Gallatin staff are confident that the Forest is fulfilling its duty for managing motorized access as per the CFRs and associated Travel Plans, and compliance issues are relatively minor (J. Kempff, pers. comm. 2019.) Finally, under terms and conditions for the Gallatin Forest Travel Plan, the Forest reports to the U.S. FWS annually regarding effectiveness of road and trail closures to restrict use by wheeled, motorized vehicles, as well as effectiveness of gate closures on administrative routes to preclude motorized use by the general public (USDI FWS 2013). For these reasons, we believe the processes for monitoring and measuring of secure habitat levels are based upon the best available information, and have a high level of accuracy in reflecting relative proportions of secure habitat on the ground.

The primary factor affecting secure habitat for grizzly bears is proximity to motorized access routes. Other indices useful for evaluating impacts from motorized access include measures of motorized access route densities. Route densities of particular concern with respect to grizzly bear habitat management are open motorized access routes (OMARD) $> 1 \text{ mi/mi}^2$ and total motorized access routes (TMARD) $> 2 \text{ mi/mi}^2$ (Mace and Manley 1993, USDI FWS 1995), where OMARD represents routes open to the general public and TMARD includes routes open to the public as well as motorized routes restricted to administrative use. Route densities are correlated to secure habitat in that areas of higher route densities have lower proportions of secure habitat. In developing the conservation strategy it was determined that, maintaining habitat standards for all three access parameters (OMARD, TMARD and secure habitat), was unnecessary and somewhat redundant in meeting grizzly bear management objectives (USDA 2006a). The revised plan follows suit with the conservation strategy by adopting

standards for maintaining secure habitat inside the recovery zone, with no associated standards tied specifically to route densities. Constructing a new motorized route or reopening a previously closed motorized route would typically affect secure habitat, unless the new/reopened route is within 500 meters of an existing motorized route on both sides. In other words, for a new/reopened route to have no effect on secure habitat, it must be between existing motorized routes that are no more than 1,000 meters (0.6 mi) apart. Such an event would be rare, and would not likely have any notable effect on the proportion of area with OMARD > 1 mi/mi² or TMARD > 2 mi/mi².

Schwartz and others (2010) looked at hazards affecting grizzly bear survival in the Greater Yellowstone Ecosystem, and concluded that of all the covariates they examined, the amount of secure habitat within a bear's home range and density of roads outside of secure habitat were the most important predictors of grizzly bear survival. They found that measures of open (OMARD) rather than total motorized route density (TMARD) best depicted grizzly bear survival. Under the revised plan, inside the recovery zone, secure habitat levels would be maintained at or above 1998 baseline levels, which have been documented to contribute to population growth for the Yellowstone grizzly bear. While there would be no formal mandate to maintain secure habitat levels outside the recovery zone, other plan components discussed above combined with direction in CGNF Travel Management Plans, would effectively limit development of additional public motorized routes on NFS lands, which would moderate OMARD levels outside the recovery zone. Therefore, the revised plan would implement access management direction which, combined with Travel Plan direction, is expected to maintain high levels of grizzly bear survival within the recovery zone, and reasonable levels in the remainder of the action area. Finally, the revised plan maintains monitoring requirements to track changes in OMARD and TMARD inside the recovery zone (MON-WL-10). Monitoring changes in OMARD and TMARD inside the recovery zone, as well as secure habitat inside and outside the recovery zone, will allow CGNF managers, in cooperation with other agencies, to respond to demonstrated issues with appropriate management actions.

Developed Sites

As with the importance of secure habitat for grizzly bears, the effects of human developments have long been recognized as having a notable influence on grizzly bear populations, particularly as such developments have been associated with grizzly bear displacement, and human-caused grizzly bear mortalities (Mattson et al. 1987, USDI FWS 1993). Developed sites are those sites or facilities on NFS lands with features intended to accommodate administrative needs and public recreational use. Human use at developed sites can produce disturbance factors such as noise and human presence that may displace wary bears from otherwise suitable habitat. In addition, developed 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.

The revised plan contains desired conditions for human-related attractants to be unavailable to all wildlife, for natural foraging patterns to be the norm, and for food conditioning, habituation of animals and associated wildlife conflicts to be minimal (FW-DC-WL 08). Specific to grizzly bears, the plan contains a desired condition for developments inside the recovery zone to remain focused in areas where concentrated use was present in 1998 (FS-DC-WLGB 01), which would maintain the distribution and general configuration of developed sites inside the recovery zone in a pattern similar to that which promoted grizzly bear recovery. However, as noted previously, GYE land managers recognize the need

to incorporate flexibility in a manner that strikes a balance between management needs and habitat protection to allow for grizzly bear and human co-existence. To accomplish this, the revised plan would incorporate pending changes to the conservation strategy that would allow greater management flexibility to increase the number and/or capacity of developed sites to address recent, unprecedented human population growth (in both permanent and seasonal residents) in the GYE as well as dramatic increases in visitor use of public lands (Landenburger 2019, unpublished).

All previous versions of the GYE conservation strategy have recommended that the number and capacity of developed sites inside the recovery zone be maintained at or below levels existing in 1998, under the premise that 1998 was reflective of a period of grizzly bear expansion, which led to the GYE grizzly population ultimately meeting established recovery criteria. However, previous methods of applying the developed site standards from the conservation strategy merely tallied the number of developed sites within the recovery zone, with little distinction between the sizes of development. For example, a one-tenth acre developed trailhead ‘counted’ the same as the Grant Village complex in Yellowstone National Park. Nor did previous tracking methods clearly distinguish between the types of use at developed sites (e.g. administrative sites vs public recreation areas vs combined administrative and public use sites). Further, previous methods had no established protocol for measuring the capacity of existing developed sites relative to the 1998 baseline (Landenburger 2019, unpublished).

To address emerging management issues, a multi-agency technical team (Tech Team) proposed changes to conservation strategy habitat standards for managers’ consideration. The most significant recommendation to come from this effort is to apply the “footprint approach” to larger areas of concentrated human use associated with developed sites, as described previously. The rationale for adopting the footprint approach is that it 1) affords a more reliable, consistent, and accurate method of representing and tracking human development, 2) better accounts for impacts to secure habitat associated with concentrated human use and development, 3) delineates prescribed areas within which managers may authorize new or enhanced infrastructure without violating habitat standards, 4) concentrates new infrastructure in those areas already developed and rendered non-secure habitat incompatible with grizzly bear occupation, and 5) remains consistent with the intent of the original 1998 habitat standards baseline (Landenburger 2019, unpublished). Not all developed sites warrant the footprint approach, smaller developed sites (e.g. trailheads, backcountry cabins) are still treated as points on the landscape, as opposed to the polygons ascribed to footprints around larger developed sites.

Under current tracking measures, the number of developed sites on the Custer Gallatin has dropped from 183 in 1998 to 177 at the time this BA was written (van Manen et al. 2019). Forest managers have attempted to remain true to the conservation strategy recommendation for no increase in capacity at developed sites, but due to lack of established protocols for measuring site capacity, this aspect of the conservation strategy has been difficult to assess for a variety of reasons. For one, the National Forest System does not place limits on the number of individuals that may occupy a developed site. For example, an individual campsite in a developed campground may be occupied by one or a dozen individuals on any given day, or not occupied at all. The same goes for smaller developed sites; a backcountry cabin may be occupied by one or a dozen individuals in one day, or not occupied at all. To meet the intent of the conservation strategy to not increase human capacity at developed sites, the Forest has focused capital investments at existing sites to protect resources (e.g. adding food storage facilities and replacing toilets), rather than adding infrastructure (e.g. new parking pads, tent sites, picnic

tables) specifically for the purpose of increasing capacity at existing sites. While there are no specific limits placed on the number of individuals that may occupy a given developed site, once the site is occupied, it is unavailable to newcomers looking for a site-specific recreation opportunity such as such as a developed campsite, picnic area, or rental cabin.

Given the recent and dramatic increase in human use of public lands in the GYE, demands for recreation opportunities have increased accordingly on the Custer Gallatin National Forest. Since the Forest abuts Yellowstone National Park on two of four sides of the park, and also adjoins three of the five entrances to the park, visitation to Yellowstone Park has an additive influence on recreation demands for opportunities presented on the Custer Gallatin National Forest. Most notably, when campgrounds, lodges and resorts fill up and visitors cannot find overnight accommodations inside the park, they frequently look for opportunities on adjacent NFS lands, including those administered by the Custer Gallatin. Frequently, such visitors are not prepared to travel substantial distances from their vehicles to find camping opportunities, so they seek out developed sites accessible by vehicles on the Forest. Since the Custer Gallatin is a destination recreation area in its own right, most developed recreation sites are typically fully occupied during peak seasons. A domino effect can occur when developed sites on the Forest fill up, and the “spill-over” of visitors then becomes concentrated along nearby Forest roads, where visitors seek out suitable locations for dispersed camping accessible by vehicle. Most dispersed camping areas do not have infrastructure to accommodate the same types of use as developed sites (e.g. access roads, parking, toilets, contained fire pits, picnic tables, garbage receptacles, etc.), and consequently, high levels of dispersed use sometimes result in resource damage.

In all versions of the conservation strategy, dispersed recreation sites have not been counted toward the developed site standard. However, previous versions (2007, 2016) of the conservation strategy acknowledged that consolidation and/or elimination of dispersed campsites is considered adequate mitigation for increasing capacity at existing developed sites, or for creation of new minor day-use sites. Proposed changes to the conservation strategy, including the footprint approach to managing larger developed sites in the recovery zone, would allow for increased capacity within authorized footprints without mitigation. As explained previously, part of the rationale for adopting the footprint approach is to better account for impacts on secure habitat imposed by concentrated human use areas. Using that same logic, the Tech Team also recommended that increased demands for services provided by developed sites could be accommodated within the non-secure buffers around primary roads inside the recovery zone. Primary roads include paved, two-lane, federal highways with high speed and high volume traffic, which present high disturbance as well as high mortality risk to bears, and therefore already impact secure habitat to a high degree. Tech Team recommendations for additional developed sites along primary roads inside the recovery zone would allow new, day-use sites within 300 meters (1,000 feet) of the primary road (either side). Primary roads within the Custer Gallatin portion of the recovery zone include Highway 20 south of Hebgen Lake, Highway 287 north of Hebgen Lake, Highway 191 in Gallatin Canyon, Highway 89 in the Yellowstone River Canyon and Highway 212 near Cooke City (see Figure 15 for location of primary roads).

The Custer Gallatin revised plan would adopt the recommendations of the Tech Team for revising the conservation strategy (FW-STD-WLGB 04). Adjusting the developed site standards to allow for increased capacity at existing larger developed sites (within the existing footprint) and to allow for increased numbers of developed sites within the non-secure corridors along primary roads, would constitute a notable change in the way developed sites have traditionally been managed on the Custer Gallatin.

Larger developed sites that would now fall under the footprint approach are all located on the Gallatin portion of the recovery zone, as are all of the primary road corridors that would be open for additional developed sites.

Added management flexibility would be beneficial to CGNF land managers, because overflow from existing developed sites is currently contributing to resource damage resulting from unmanaged dispersed use in some areas. Consequently, some additional development is reasonably expected to occur within CGNF campgrounds identified in the footprint approach, as well as some additional development within 300 meters of primary roads. The Forest currently has no detailed or specific plans for such development, as the proposed change to the conservation strategy has just been finalized, and has yet to be formally approved by the YES. Therefore, a relatively simple GIS exercise was used to estimate the amount of added development that could conceivably occur within the footprint of existing developed campgrounds. This exercise predicted the number of new sites that might be added within the footprint of existing campgrounds based on an estimate of 5 acres per site to accommodate individual site infrastructure (e.g. parking pad, tent site, fire grate, picnic table), common use infrastructure (e.g. toilets, water fountains, garbage disposal), as well as to account for some degree of privacy and aesthetics. New road estimates were extrapolated from miles of existing roads per existing campsite. This exercise revealed that there are currently approximately 582 acres inside the recovery zone attributed to footprints around developed campgrounds, with a current total of 460 individual campsites within the footprint campgrounds. Based on total acreage for all footprint campgrounds, there is capacity for 703 new sites distributed across all the existing footprint campgrounds. There are currently about 16 miles of road within the combined campground footprints, and an estimated need for up to 35 additional miles to access all new sites. Table 28 shows the breakdown of new sites and new road for each individual footprint campground.

Table 28. Potential expansion within footprint of existing developed campgrounds

Campground Name	Footprint Size (acres)	# Existing Sites	# Potential New Sites	Existing Roads (mi)	Potential New Roads (mi)
Bakers Hole	67.1	75	59	1.9	1.5
Bear Creek	13.4	5	22	0.5	2.4
Beaver Creek*	133.9	64	204	2.9	9.1
Canyon	22.7	15	30	0.9	1.9
Cherry Creek	6.5	8	5	0.2	0.1
Chief Joseph (CLOSED)	11.4	6	17	0.4	1.2
Colter	37.7	18	57	1.3	4.2
Eagle Creek	29.3	15	44	0.8	2.3
Hicks Park	22.4	16	29	0.8	1.5
Lonesomehurst	17.2	27	7	0.7	0.2
Rainbow Point	55.3	86	25	1.7	0.5
Red Cliff	60.6	67	54	1.5	1.2
Soda Butte	54.6	27	82	1.6	4.7
Spring Creek	9.9	15	5	0.2	0.1
Timber Camp	10.0	3	17	0.3	1.6
Tom Miner	29.7	13	46	0.6	2.2
Totals	581.7	460	703	16.3	34.7

*Only 36 acres of Beaver Creek footprint polygon are inside the recovery zone.

The amount of acreage affected by the footprint approach for developed campgrounds is infinitesimally small relative to the acreage of habitat within the recovery zone on the Custer Gallatin Forest (about six one-hundredths of one percent). While the predicted number of new sites (703) seems like a substantial number, the number is likely considerably overestimated for a number of reasons. For one, the GIS exercise did not account for topography or site suitability for construction. Footprints were created by buffering existing infrastructure, and as a result, several of the campground footprints contain water bodies, roads, cliffs, and other features that would not permit construction of new sites. Not all footprint campgrounds on the Custer Gallatin are equally popular with the recreating public; and one (Chief Joseph) is currently closed, with no reasonable expectation of increased development. The Chief Joseph Campground is relatively small, with little influence on overall predicted future development. However, the Beaver Creek Campground, which is the largest of the footprint campgrounds at 134 acres, is mainly (98 acres) outside of the recovery zone. All of the existing campsites in the Beaver Creek polygon are outside the recovery zone. It was only through adoption of the footprint approach that this campground was included as a developed site inside the recovery zone. Therefore, estimated future development for this campground is highly inflated relative to what could occur inside the recovery zone. Since Beaver Creek has the largest footprint, which accounts for nearly 30 percent of the campground footprint acres on the Forest, the entire amount of predicted increase in infrastructure is likewise inflated.

Finally, construction of campground facilities is a costly proposition, and capital investment funds set aside for recreation and administrative facilities are very limited and highly competitive agency-wide. Within the next five years, there is limited funding available across the entire agency, with much of what is available likely to be spent on replacement of existing aging infrastructure. Therefore, the amount of new construction within existing footprint campgrounds over the life of the plan is likely to be considerably less than estimated in this exercise. However, there may be new initiatives that emerge to finance new facilities at some point over the life of the plan, though there is not enough certainty to establish if, when or where there might be funds available to finance expansion within existing developed campgrounds on the Custer Gallatin.

Another category of developed sites that warranted the footprint approach includes administrative sites, of which there are seventeen that received a footprint on the Custer Gallatin, all of which are located on the Gallatin portion of the Forest. It is reasonable to assume that over the life of the plan, there will be needed maintenance, repairs and/or additions at administrative sites in order to maintain or enhance public land management. Currently, the only identified need for any type of expansion or increased capacity within the administrative footprints specifically addressed in the revised plan is in the OTO administrative site in the Hellroaring Bear 1 subunit. The OTO is an historic Dude Ranch, which was acquired by the Forest Service in 1991. The Forest Service, with a variety of partners, completed historic preservation of the OTO in the early 2000s. In addition to preservation-associated work, the OTO has provided housing for administrative personnel. Preservation work was conducted during the summer, and typically resulted in approximately three weeks of overnight use and four weeks of daytime use by volunteers working on preservation projects. Over time there has been increased interest from the public to utilize the OTO facility for other purposes, most notably youth/environmental education. For several years now, the Forest has welcomed youth education groups to the OTO within the same temporal frame as historic preservation activity to adhere to the developed site capacity limit. While

there is no proposal or identified need to increase infrastructure within the administrative footprint, the Forest is proposing to increase the temporal aspect of use by the public.

The revised plan recognizes the distinctive contributions of the OTO Dude Ranch, now an administrative site, to the cultural and historic characteristics of the AB Geographic Area. Accordingly, the plan contains a goal for the Forest Service to seek partnerships to provide a venue for conservation education, stewardship and innovative opportunities, while preserving the historic significance and use of National Registered Listed OTO Homestead and Dude Ranch property (AB-GO-OTO 01). Under the revised plan, use of the OTO administrative site would not be opened to the general public under a rental program (AB-STD-OTO 03). Non-administrative use of the facilities (e.g. buildings) would require authorization by special use permit or agreement (AB-STD-OTO 01). Group size authorized would be limited to a maximum of 75 individual for overnight use, and 100 individuals for day use (AB-STD-OTO 02). Administrative use could occur year-round with no timing or group size restrictions. Non-administrative use may occur year-round, but would be limited during prime grizzly bear use seasons. During fall hyperphagia, when bears are moving extensively with increased chances of encountering humans, use authorized by permit or agreement at the OTO would be limited to no more than one week of overnight use and no more than three weeks of day use from October 1 to December 1 (AB-GDL-OTO 01). During the spring den emergence season, when bears may visit the OTO site due to the potential presence of winter-killed ungulate carcasses on winter range in the area, such use would be limited to no more than two weeks of overnight use and no more than two weeks of day use from March 1 to June 15 (AB-GDL-OTO 02). Similar to the current condition, the bulk of authorized public use is expected to occur during the summer months (June 16 to September 30), when grizzly bears have typically moved to higher elevation areas in search of natural foods. However, under the revised plan the facilities would also be open to authorized public use (both overnight and day use events) during the winter denning season (December through February). Whereas public use of the administrative facilities (buildings) would be allowed only for authorized events, the general public would be allowed to recreate within the admin site (footprint) (AB-SUIT-OTO 01).

The proposed footprint approach for administrative sites would allow for additional infrastructure at existing administrative sites in the recovery zone, should needs arise to accommodate additional administrative workforce, changing technologies, and/or need to upgrade or replace existing facilities due to wear and tear, as well as to ensure the health and safety of our workforce and cooperators. The major difference is that under the revised conservation strategy language (and correlated revised plan components), any new construction at the larger administrative sites must be entirely within the authorized footprint, whereas previous versions (2007, 2016) of the conservation strategy (and existing forest plans) basically exempted administrative facilities from the “no added capacity” provision of the developed site standard altogether. The revised language would ensure that any future added capacity at administrative sites would be concentrated in the same general vicinity as existed in 1998, and prevent potential sprawl at larger administrative sites.

The third category of developed site that received a footprint on the Custer Gallatin, was termed “visitor overnight” sites by the Tech Team, which applies to visitor lodges and guest ranches operating under special use permit on NFS lands inside the recovery zone. There are two such sites on the Custer Gallatin; the Covered Wagon Ranch in the Hilgard 1 subunit, and the Madison Arm Resort in the Madison 2 subunit. These developed recreation sites accommodate visitor overnight use in cabins and campsites suited for tent or RV use. By adopting recommended changes for the conservation strategy,

the revised plan would allow new infrastructure to be added at these sites, so long as it is fully encapsulated within the established footprints, and could accommodate no more than a ten percent increase over current visitor capacity. Special use permits for these sites have not set numeric limits for visitor use. However, these sites were both present in 1998, with no infrastructure added to accommodate additional overnight guests on NFS lands since that time. Therefore, the maximum visitor capacity at these sites today is the same as it was in 1998. Under the provision to allow expansion within authorized footprints, the Covered Wagon Ranch could add infrastructure to accommodate 2-3 additional overnight guests, while the Madison Arm resort could add infrastructure to accommodate up to thirty additional overnight visitors, within their respective footprints.

The final major change to management of developed sites within the recovery zone is the addition of a provision to allow new developed sites to be constructed within a 300 meter (1/5 mi) buffer of primary roads, without mitigation. There are five primary roads (paved federal highways listed above) that intersect Custer Gallatin lands inside the recovery zone (see figure 15). The rationale for adding this provision is that all motorized routes are already buffered by 500 meters (1/3 mi) and the area within that buffer is subtracted from secure habitat. Primary roads receive the highest volume traffic, and accommodate the highest traffic speeds, which results in the greatest disturbance effects to grizzly bears, and at the same time, poses the highest mortality risk for bears that attempt to cross. New developed sites in these areas would have additive disturbance and mortality risk for bears, but these impacts would be minor relative to existing conditions near these roads. There is abundant literature demonstrating grizzly bear avoidance of roads (IGBC 1987) including research specific to effects of developments and primary roads on grizzly bear habitat use in Yellowstone National Park (Mattson et al. 1987). The primary road provision added to grizzly bear direction is consistent with revised plan land use allocations, since all of the primary road segments within the grizzly bear recovery zone are identified as recreation emphasis areas in the revised plan (see figure 2 and figure 3). Accordingly, it is reasonable to expect some added development in these areas may be desirable to accommodate recreational use over time. However, there are currently no specific plans to add developed sites within primary road buffers on the Forest, and there is no good way to estimate how many such developments might occur over the life of the plan, since conditions are so variable along the primary road segments.

Existing conditions provide a basis to consider potential effects of new plan language. Buffering primary roads inside the recovery zone by 300 meters on each side, produces an area of roughly 16,502 acres. Of this area, over a third (5,726 acres) is located on non-NFS lands (generally private), over which the Forest Service has no control, and for which future development would not count against the developed site standard. NFS lands within this buffer account for just over one percent of the total Custer Gallatin lands inside the grizzly bear recovery zone. On the roughly 10,755 acres that are NFS lands, there are currently over 300 individual structures within the primary road buffers. This number accounts for smaller developed sites, like trailheads or recreational residences, but also includes individual structures (e.g. admin buildings, individual campsites, bathrooms, picnic areas) within some of the larger developed site footprints on the Forest. Currently, twelve of the administrative site footprints, seven of the campground footprints (including Beaver Creek – the largest), and one of the visitor overnight footprints on the Custer Gallatin overlap with the primary road buffers. This co-location of 60 percent of the developed site footprints on the Forest with the primary road buffer, would further concentrate potential future development that would be allowed without mitigation under revised standards for developed sites. The resulting management scenario would be consistent with the intent of the conservation strategy to keep developed human uses in the same general location as were used in 1998.

In addition to structures (described above) there are currently approximately 36 miles of open roads and 3 miles of administrative (gated) roads within the primary road buffer on NFS lands (not counting the primary roads themselves). The NFS acreage within the primary road buffer equates to roughly 17 square miles, resulting in approximately 2.3 miles of existing motorized routes on NFS land within the primary road buffer (again, not counting the primary roads themselves). While this level of road density is not excessive for highly developed areas, and there could be reason to add more access routes in the future, it does indicate that there is currently considerable access for public and administrative use within the primary road buffers on the Custer Gallatin. Also of note, nearly 26 miles of road have been decommissioned through Travel Plan implementation on NFS lands within the primary road buffers. These routes were removed after careful consideration of current and future access needs, or because their location and use was causing resource damage. Therefore, it is not anticipated that any new access routes would be located where roads have recently been decommissioned. Finally, any new roads associated with new development within 300 meters of a primary road would be buffered for impacts to secure habitat as per the Access Model for grizzly bears in the GYE. The revised plan mandates that such new roads and associated buffers will not reduce existing secure habitat below established baseline levels, further limiting potential new developments.

While it is reasonable to expect some level of added recreation infrastructure within the primary road buffers in the recovery zone, there are also a number of factors that would limit such development. For example, the application rules proposed for the revised direction in the conservation strategy (and related components in the revised plan) require new developments within the primary road buffer to be for day-use only; non-commercial in nature; and located outside of known grizzly bear (conservation strategy) or other wildlife (revised plan) crossing areas, riparian areas, ungulate calving/fawning grounds, and whitebark pine stands (FW-STD-WLGB 04c). Limiting new sites to day use only would reduce the duration of human presence, thereby lowering the potential for grizzly bear-human conflicts, while restricting new sites to non-commercial uses would limit the demand for development that could be motivated by financial considerations. Habitat factors could rule out individual developments when considered on a case-by-case, site-specific basis. Most of the primary road segments are at least partially along river corridors or lakeshore, with potential limits to added development based on riparian habitat protections, and presence of whitebark pine could limit new development along Highway 212.

Not only would the grizzly bear plan components limit future developments in riparian areas, but the revised plan contains a variety of standards and guidelines (FW- GDL-RMZ 04; FW-STD-RT 01-05; FW-GDL-FAC 01-03; FW-GDL-LANDUSE 04) that would also limit new development in riparian areas. Roughly 26 percent of the primary road buffer on NFS lands is within riparian management zones, where new construction would be limited to some degree by these plan components. Finally, about 36 percent of the NFS lands in the primary road buffer are located along eligible Wild and Scenic Rivers (Gallatin, Yellowstone and Madison Rivers). For eligible rivers, NFS lands within ¼ mile of the river bank (both sides) must be managed to protect the identified river-related values that warrant eligibility. Although permanent developments are not prohibited in Wild and Scenic River corridors, plan components associated with the Wild and Scenic Rivers (FW-STD- EWSR 01, FW-GDL-EWSR 01) could influence the types of developments that would be allowed in some areas. Finally, effects to secure habitat from adding new sites within 300 meters of primary roads would be minimized by the revised plan requirement that new roads within 300 meters of a primary road shall not reduce existing secure habitat below established baseline levels (FW-STD-WLGB 04c).

Previous versions of the conservation strategy (2007, 2016) allowed for consolidation and/or elimination of dispersed campsites to mitigate for expansion at existing developed campgrounds; for conversion of uncontrolled dispersed campsites to a new minor day-use site for human safety and benefits to bears; and for modifications to dispersed campsites to reduce resource damage and/or reduce potential for grizzly bear–human conflicts. Adopting the footprint approach in the conservation strategy would eliminate the need for the first allowance, since capacity could be added at developed campgrounds without consolidation or elimination of dispersed campsites. The revised plan incorporates the logic of previous strategies combined with recommended changes, to allow for minor modifications at dispersed recreation sites to address resource damage and/or reduce potential human-grizzly bear conflicts, but specifies that modifications must accommodate the same type and level of use occurring at existing dispersed sites (FW-STD-WLGB 05b). The revised plan also would allow for consolidation and elimination of dispersed recreation sites to be acceptable mitigation for new developed sites (e.g. day use sites or campgrounds), so long as the new site capacity is commensurate with the type and level of use provided by the previous dispersed sites. Dispersed sites replaced by the new developed site must be restored and those areas would then be closed to the public for future vehicle access and overnight use (FW-STD-WLGB 05d). These changes were needed to address ongoing and potential future resource issues associated with unmanaged dispersed recreation use.

For years now, unmanaged recreation has been recognized as one of the main threats to the health of the Nation’s Forests. The Rockies are identified as an area that has been notably impacted by human population growth, and where heavy pressure from increased recreation use is predicted to continue. Impacts from unmanaged recreation include soil erosion, spread of invasive species, disturbance of wildlife, destruction of wildlife habitat and risks to public safety (www.fs.fed.us/projects/four-threats). As noted previously, a major impetus to revise the application rules for developed sites in the conservation strategy is because existing direction for developed sites in the recovery zone has not kept pace with management challenges associated with increasing pressure on natural resources from growing human use. The Custer Gallatin has responded to resource damage by closing some areas to dispersed camping altogether, and by designating dispersed sites in others. Frequently, Forest visitors would prefer a developed recreation experience, but when developed sites are full, these visitors may opt to seek out dispersed opportunities, or may find they have few other options available. When resource damage results from dispersed use, combining the sites contributing to resource impacts into one developed area serves to concentrate the use, and allows for better control over factors such as food storage, noise levels, and sanitation, all of which can impact bears.

Early versions of the conservation strategy (2003, 2007) acknowledged that developed sites can result in displacement of grizzly bears; i.e. developed sites affect secure habitat, which would be more accurately accounted for under the proposed footprint approach to track larger developed sites. However, early versions of the conservation strategy indicated that the primary concern related to developed sites is grizzly bear mortality related to human foods and other attractants connected to food conditioning and habituation of bears. A food storage order has been in place inside the recovery zone since the mid-1980s and was expanded to cover the entire montane ecosystem of the Custer Gallatin in 2007. The revised plan includes a standard (FW-STD-WL 01) to maintain and enforce the food storage order in areas where grizzly bears are currently present on the Forest, as well as areas where they are reasonably expected to move through or into during the life of the plan. The revised plan also acknowledges the importance of informing the public about proper behavior in bear country (FW-DC-WLGB 03). Food storage regulations combined with information and education efforts, have been credited with reducing

grizzly bear-human conflicts and subsequent need for management control of grizzly bears. As a result, bear-human conflicts have shifted away from developed sites, and are now more frequently associated with surprise encounters in back-country scenarios (Frey and Smith *in* van Manen et al. 2019).

Inside the recovery zone, developed site plan components adopted from the conservation strategy would serve to continue to concentrate human use in areas where higher levels of human presence occurred in 1998, yet allow for management flexibility to address the emerging issues associated with largely unmanaged dispersed use. Relaxing the developed site standards to allow for some increased human presence at existing developed sites through expanded capacity, as well as possible increases in the numbers of developed sites within the primary road buffer and through consolidation of dispersed sites, could have added disturbance effects on bears in close proximity to expanded or new developments. However, bears that utilize habitats near high human use areas typically have a higher tolerance for human presence, whereas the more wary bears tend to avoid areas of concentrated human use. Allowing more management flexibility for developed sites could reduce disturbance impacts from dispersed use in some areas. However, given the recent, current and predicted growth of the human population in the GYE, dispersed use on the Custer Gallatin is also expected to continue to increase over the life of the plan, and reduced disturbance for bears is likely to occur only through the issuance of special orders to prohibit dispersed use in certain areas. Public education combined with food and attractant management at developed sites has proven effective at reducing bear-human conflict at developed sites, and is expected to continue to do so under the revised plan.

Developed sites are also a factor affecting grizzly bear use outside the recovery zone. The Grizzly Bear Recovery Plan (USDI 1993) acknowledges that the area outside the recovery zone will be managed with more consideration for human uses. Consequently, there have been no forest plan limits on developed sites outside the recovery zone under existing plans, nor would there be any grizzly bear-specific restrictions on developed sites outside the recovery zone in the revised plan. However, as noted above for secure habitat, a variety of plan components associated with other resources would limit new developments outside the recovery zone as well. Designated wilderness areas account for 44 percent of NFS lands outside the recovery zone, in which no new developed sites would be allowed. Land use allocations in the revised plan for recommended wilderness areas, backcountry areas, and key linkage areas would prohibit new recreation and other developments in these areas outside the recovery zone (FW-STD-RWA 01-06; FW-STD-BCA 01-07; FW-GDL-WL 03, 04). Proportions of these land allocations where new development would be limited outside the recovery zone are shown in table 27. The revised plan includes a desired condition that developed recreation facilities keep visitor use concentrated rather than shifting use to new areas (FW-DC-RECDEV 06), and precludes new developments for recreation residences both within and outside of the recovery zone (FW-STD-RECRES 01, 02). Additionally, the Food Storage Order would continue to apply at all developed sites (as well as dispersed use areas) outside the recovery zone under the revised plan (FW-STD-WL 01).

Finally, the revised plan includes goals to assist in interagency efforts to track, record, and/or report grizzly bear-human conflicts and also to identify potential relocation sites for grizzly bears involved in conflicts with humans (FW-GO-WLGB 02, 03). These goals reflect management intent to continue to participate in ongoing interagency efforts to monitor incidents in which grizzly bears and humans cross paths, evaluate conditions that may have led to conflicts and/or avoided conflicts, and if need be, respond to demonstrated issues in cooperation with other agencies. Having suitable relocation sites identified in advance can help streamline and expedite the process for dealing with grizzly bears

involved in minor conflicts with humans, while allowing bears to learn from negative experiences yet remain in the ecosystem.

Domestic Livestock Grazing

The third major emphasis area in the conservation strategy (and reflected in the revised plan) is domestic livestock grazing management. Under the revised forest plan, the number and acres of permitted livestock grazing allotments inside the recovery zone would remain below levels that occurred in 1998 (refer to table 25). Since there has been a reduction in the number of grazing allotments since 1998, livestock could be restocked in some areas inside the recovery zone, and still be within the constraints of plan direction and consistent with the conservation strategy. In 1998, there were 39 permitted grazing allotments inside the recovery zone covering a total of 271,865 acres. Currently, there are 14 active and 5 vacant allotments inside the recovery zone, for a total of 74,292 acres. Under the grizzly bear plan direction consistent with the conservation strategy, it would be permissible to restock domestic grazing animals on 25 allotments (including 5 currently vacant) over 214,000 acres within the recovery zone. However, many (20) of the allotments available for livestock grazing in 1998 have been permanently closed for a variety of resource reasons, including potential conflicts with grizzly bears. The revised plan would allow for evaluating a variety of uses for current and future vacant grazing allotments, including but not limited to stocking or closing the allotments per Forest Service policy (FW-GO-GRAZ 02). The 5 allotments inside the recovery zone that are currently vacant could be restocked with permitted livestock (other than domestic sheep), or used as forage reserves for permitted livestock, which would affect approximately 17,040 acres, and could support roughly 1,429 AUMs. Alternatively, these 5 vacant allotments could be considered for closure in favor of natural resource conservation, including, but not limited to, minimizing risks to grizzly bears.

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 2017a). Grizzly bear depredations on livestock can result in injury or removal of bears. While it is possible that the number and acreage of permitted livestock grazing allotments could increase inside the recovery zone compared to current levels, no new domestic sheep (or goat) allotments would be authorized, unless for the express purpose of administrative use for noxious weed control (FW-STD-GRAZ 02). 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. Revised plan direction would require mitigation measures, including written instructions stipulating the timing, location, numbers of animals, retrieval of strays, disposition of livestock carcasses, or any other mitigation measures deemed necessary to minimize risk of conflict with grizzly bears (FW-STD-GRAZ 03 and 04). Other mitigation measures might include such things as, requirements for full-time supervision of weed-control livestock by humans and/or guard animals, use of electric fencing or other suitable measures to keep livestock in the target area while keeping predators out, or notification requirements if grizzly bears or signs of grizzly bears are seen in the area of livestock use. In the event of a grizzly bear conflict with domestic sheep and/or goats used for weed control inside the recovery zone, the management response would favor grizzly bears (FW-STD-WLGB 07); i.e. livestock would be removed from the area, with no adverse actions against the bear(s) involved unless additional circumstances indicate removal is warranted. Such circumstances may include, but are not limited to, bear-caused

human injury or mortality, or the bear(s) involved are determined to be food-conditioned or in poor health and not expected to survive in the wild.

Outside of the recovery zone, permitted livestock grazing would be less restricted under the revised plan relative to inside the recovery zone, but would be more restricted relative to existing plan direction. Outside the recovery zone, there are currently 51 active cattle/horse allotments and 12 vacant allotments in the AB and MHG GAs, where grizzly bears are known to occur. The active allotments would likely remain stocked with cattle or horses, and the vacant allotments could be restocked for regular use, or used as needed (e.g. grass banks) for livestock. However, under the revised plan, no new permits would authorize grazing of domestic sheep or goats for livestock production anywhere in the montane ecosystem of the Forest (FW-STD-GRAZ 02). While there are currently no active or vacant sheep/goat grazing allotments anywhere on the Forest, there are no restrictions under existing plans that would prevent new permits for domestic sheep/goats outside the grizzly bear recovery zone. The addition of a prohibition on domestic sheep/goat permits for livestock production anywhere in the montane ecosystem GAs was added in the revised plan not only to protect large predators such as grizzly bears, but also to protect wild sheep and goats that are susceptible to disease transmission from domestic livestock. The revised plan would eliminate the potential for future permitted grazing of domestic sheep/goats for livestock production in all areas of the Forest currently known to be occupied by grizzly bears (AB and MHG GAs), as well as areas that could potentially serve as dispersal corridors for grizzly bears in the future (BBC GA).

Similar to inside the recovery zone, targeted use of domestic sheep/goats would be allowed outside the recovery zone under the revised plan, with appropriate mitigations. Targeted grazing by domestic sheep/goats is an effective method of controlling the spread of invasive plants. Noxious weeds can out-compete native plant species, and subsequently overtake large areas of native habitat. Maintaining a variety of tools to manage invasive plants is expected to benefit a wide range of native wildlife species, including a number of herbivores that are potential prey species for grizzly bears. The primary difference in plan direction for use of domestic sheep/goats for weed control outside the recovery zone, is that there is no requirement for management actions to favor grizzly bears over livestock in the event of a conflict outside the recovery zone. However, plan components requiring mitigation measures to minimize disease transmission between domestic animals used for weed control and bighorn sheep, would also limit potential for conflicts with grizzly bears outside the recovery zone. In the event of a conflict between grizzly bears and weed-control livestock outside the recovery zone, additional factors would be considered in management actions, including but not limited to economic impacts on the livestock owners. After consideration of multiple factors, livestock could still be removed from a weed-treatment area, and there may be no adverse actions for the offending bear(s). Alternatively, grizzly bears may be relocated or removed if they are involved in depredation or conflicts with livestock operations authorized for weed control purposes outside the recovery zone.

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). The revised plan contains a goal (FW-GO-GRAZ 01) 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 (FW-STD-GRAZ 01; FW-GDL-GRAZ 01, 02, 04). The revised plan would be 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 (FW-GDL-GRAZ 03). This component would help sustain the big game herds that contribute ungulate biomass as a key food source for grizzly bears. The revised plan would carry forward components from existing plans that prohibit stocking grazing allotments with domestic sheep inside the recovery zone, and would prohibit permitting of new grazing allotments for production of domestic sheep and goats, not only where grizzly bears are known to occur, but also in areas where grizzly bear dispersal to facilitate genetic mixing with other ecosystems is desirable (FW-STD-GRAZ 02). These changes would improve conditions for grizzly bears compared to the current plans.

Grizzly Bear Food Sources

The three major habitat standards for grizzly bears (secure habitat, developed sites, and livestock allotments) address factors linked to human land uses that can affect grizzly bear distribution through disturbance and/or displacement, and grizzly bear survival relative to human-caused grizzly bear mortality. In addition to these factors, the revised plan contains direction that could affect availability of key food sources for grizzly bears, vegetative cover requirements for security and thermoregulation, and habitat connectivity. The revised plan contains desired conditions for vegetation conditions that are generally within the natural (historic) range of variation, provide structural and functional diversity and are resilient to existing and predictable future stressors, thereby providing habitat for use by a diverse suite of species, and meeting a variety of life-cycle needs (FW-DC-WL 03, 06). As opportunistic omnivores, diversity is important to grizzly bears to provide a wide range of plant and animal food sources, as well as to meet needs for shelter, security, and thermoregulation.

The revised plan contains a suite of components designed to provide ecological integrity by managing vegetation within the natural range of variation, and for long-term resilience. Examples 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. Specific plan components for terrestrial vegetation, at risk plants (e.g. whitebark pine), water, and riparian areas all influence grizzly bear habitat, as well as habitat for grizzly bear prey species (FW-DC/STD/GDL-VEGF; FW-DC/GDL-VEGNF; FW-PRISK; FW-DC/GDL-WTR; FW-DC-GDL-RMZ; FW-DC/GDL-WLBG). The revised plan includes specific direction for management of whitebark pine (see Whitebark Pine Species Assessment, this BA), old growth (FW-DC-VEGF-09; FW-GDL-VEGF 01, 02), forest cover (FW-DC-VEGF 04, 06), and riparian areas (FW-DC/STD/GDL-RMZ), all of which are important habitat elements for grizzly bears in that they provide foraging opportunities, cover for security and thermoregulation, and travel corridors for grizzly bears and their prey species (Ward Thomas et al. 1988, Naiman et al. 1993, USDI FWS 2017a, Peck et al. 2017). 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.

Four key food groups have been identified for grizzly bears in the GYE. These include ungulate biomass, spawning cutthroat trout, whitebark pine seeds, and army cutworm moths (Schwartz et al. 2010, van Manen et al. 2013, Costello et al. 2016). Of these, ungulate biomass and whitebark pine, are known to be important food sources for bears on the Custer Gallatin National Forest. The revised plan contains direction for management of big game habitat, including guidelines to provide cover, and protect winter range, reproductive areas, and secure habitat (FW-GDL-WLBG 01-03). Combined with coarse-filter plan

components to provide ecological integrity through management of key ecological characteristics as described above, these specific plan components for big game are expected continue to support large, thriving herds of elk, as well as moose and deer, which would contribute to ungulate prey and carrion availability for grizzly bears. A notable change in the revised plan is recognition of the distinctive roles and contributions of bison on the Custer Gallatin, with the inclusion of specific direction aimed at expanding bison presence (spatially and temporally) on the Forest. To this end, the revised plan includes a desired condition for a year-round, self-sustaining population of bison on the Forest (FW-DC – WLBI 04), as well as guidelines to limit management-related impediments to bison movement (FW-GDL-WLBI 03), to encourage strategic management of habitat (FW-GDL-WLBI 02), and to resolve ongoing or potential bison-livestock conflicts in favor of bison (FW-GDL-WLBI 01). Addition of these affirmative plan components for bison could also improve availability of ungulate biomass for grizzly bears on the Custer Gallatin.

Certain bison plan components would be applied within the grizzly bear recovery zone (FW-GDL-WLBI 03). While it is not likely that bison would expand to fully occupy all potentially suitable habitat within current grizzly bear distribution on the Custer Gallatin during the life expectancy (approximately 15 years) of the revised forest plan, it is desirable and conceivable under revised plan direction that bison could expand beyond the current bison management zones within that timeframe. The grizzly bear recovery zone was selected as the area to focus bison management because it is an established boundary based on recognizable characteristics, encapsulates current bison management areas as well as most of the Custer Gallatin lands within the estimated pre-European settlement distribution of Yellowstone bison (White et al. 2015), restrictions are already in place limiting potential for bison conflicts with livestock (FW-STD-WLGB 06), and there is adequate habitat to support a year-round self-sustaining population of bison on the Forest. Estimates were calculated for bison carrying capacity within the grizzly bear recovery zone. Using conservative forage production and allocation parameters, it is estimated that potential bison habitat within the grizzly bear recovery zone could support approximately 1,308 bison per year. Expanded spatial and temporal presence of bison on the forest is a desired condition under the revised plan (FW-DC-WLBI 04). Managing towards this condition would benefit grizzly bears by increasing the amount of bison biomass on the forest to provide a food source for grizzly bears either through direct predation, or scavenging bison carcasses or parts left behind through natural mortality or hunter harvest.

The revised plan contains components specifically designed to protect, restore, and ultimately increase the presence of whitebark pine, which is a key food source for grizzly bears (FW-DC-PRISK 02, FW-GO-PRISK 01, FW-OBJ-PRISK 02 and FW-GDL-PRISK 02). 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 is more proactive and specific 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. Whitebark pine is currently a candidate for possible listing under the ESA. A separate species assessment is included for whitebark pine in this BA, and contains more detailed analyses relative to this important food source for grizzly bears.

Finally, the revised plan includes goals and monitoring items to follow trends of natural food sources for grizzly bears. These plan components encourage Forest Service participation in interagency monitoring of key grizzly bear foods (FW-GO-WLGB 04), and provide mechanisms for tracking general habitat conditions for providing key foods as well as overall conditions for plant and animal diversity to provide alternate food sources for grizzly bears (MON-PRISK-02, MON-VEGF-01, MON-VEGNF-01, MON-WL-01, MON-WL-06, and MON-WL-07). Monitoring is intended to help Forest staff determine whether management actions are moving the Forest landscape toward desired conditions, as well as to provide indicators of downward trends for important food sources, so that plan components and associated management actions can be amended if needed.

Habitat Connectivity

The revised plan contains a suite of plan components to provide habitat connectivity specifically for grizzly bears (FW-DC-WLGB 02), but also for wildlife in general with an emphasis on wide-ranging species such as large carnivores and wild ungulates (FW-DC-WL 05-07; FW-STD-WL 02; FW-GDL-WL 01-05). 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 2017a). 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 in the revised plan (FW-GO-WLGB 01). Dispersal of bears between the GYE and NCDE could also contribute to genetic diversity in other smaller grizzly bear populations over time as bears expand their range. In addition to desired conditions, goals, and guidelines for habitat connectivity, the revised plan identifies 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 (see figure 2 and figure 4).

The revised plan would 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 the plan as likely travel routes for grizzly bears (Walker and Craighead 1997, Cushman et al. 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 the revised plan are shown to be of high importance. Plan components that would limit new developments, impose timing restrictions on major disturbance factors, and preclude overnight recreation events (FW-STD-WL 02; FW-GDL-WL 02-05) within key linkage areas would serve to maintain the ecological integrity of potential movement corridors for grizzly bears.

The Bridger and Bangtail Ranges of the BBC GA, are identified in the Northern Continental Divide Ecosystem (NCDE) Grizzly Bear Conservation Strategy as Management Zone 2, which indicates areas to be managed for opportunistic movement of grizzly bears between ecosystems. Management emphasis for Zone 2 of the NCDE 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. The revised plan includes components (FW-DC-WL 08; FW-STD-WL 01) that would ensure the food storage order would remain in place, effectively minimizing potential for dispersing grizzly bears to get into food-related conflicts with humans. The key linkage area identified in the Bridger Range would also be managed to promote habitat connectivity and facilitate grizzly bear movement through the area.

In addition to the Gallatin/Bridger mountain connection, other potential movement corridors have been identified as likely routes for grizzly bears to move between ecosystems (Walker and Craighead 1997, Cushman et al. 2009, Peck et al. 2017). A considerable amount of National Forest System lands inside and outside the recovery zone on the Custer Gallatin are within designated wilderness (Absaroka Beartooth and Lee Metcalf). The revised plan includes land allocations for recommended wilderness and backcountry areas (which both contain land use restrictions) in juxtaposition with designated wilderness units and key linkage areas, thereby creating a well-connected system of protected areas within the Forest boundary, that could facilitate movement between the GYE grizzly bear recovery zone and other grizzly bear ecosystems (see figure 2, figure 3, and figure 4). Furthermore, coarse filter plan components for managing vegetation toward conditions within the natural range of variation (FW-DC/STD/GDL-VEGF; FW-DC-VEGNF), including conditions related to patch size for forested habitats (FW-DC-VEGF 06), would contribute to maintenance or restoration of habitat connectivity for grizzly bears.

The Custer Gallatin revised plan includes innovative and comprehensive measures to acknowledge, and affirmatively address the importance of wildlife habitat connectivity. However, regardless of forest plan direction, there are still potential barriers to grizzly bear dispersal between ecosystems, including interstate and local highways, railways, and residential developments to name a few. These features are predominantly located outside the national forest boundary, and beyond the authority of the Custer Gallatin forest plan. To address this factor, the revised plan includes goals to work with State, Federal, Tribal and other willing partners to continue to address the issue of linkage between grizzly bear ecosystems (FW-GO-WLGB 01 and FW-GO-RT 03), 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

The revised plan contains desired conditions for wildland fires that burn within a natural range of severity and frequency that allows ecosystems to function in a resilient and sustainable manner, and vegetation conditions that support natural fire regimes (FW-DC-FIRE 01, 02). Minimum impact suppression tactics are recommended to minimize natural resource damage (FW-GDL-FIRE 03). 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 (FW-GDL-FIRE 02), 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 human 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 would have a greater emphasis on fire as a natural ecological process than under the current plans. Fire and fuels management direction under the revised plan 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, which could affect secure habitat for grizzly bears. As noted in the environmental baseline description, a number of bear management subunits on the Gallatin portion of the Forest are above established baselines for secure habitat. Road construction required for timber management would be allowed in those subunits, and timber harvest projects could result in relatively large, local reductions in secure habitat, which could negatively affect grizzly bears in the project area. The Gallatin Forest Travel Management Plan requires project roads such as those built for timber harvest, to be temporary, effectively gated to restrict public use, and decommissioned after the project is complete. The revised forest plan would be consistent with direction that temporary roads should be located and constructed to facilitate removal and restoration following project use (FW-GDL-RT 02). Timber harvest and associated road building could also occur in bear management subunits that are at baseline levels, with temporary reductions in secure habitat, but impacts to secure habitat would be limited in size and duration (FW-STD-WLGB 03). Partly due to forest plan limitations on road building to protect secure habitat for grizzly bears, the majority of timber harvest for timber production would occur outside the grizzly bear recovery zone.

The 2012 Planning Rule requires identification of lands that are suited and not suited for timber production based on a variety of factors. Timber production is defined as the purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use. Therefore, on lands identified in the revised plan as suitable for timber production (also known as “the suitable base”), active vegetation management and some regular flow of timber products is expected to occur. Within the area where grizzly bears are currently known to occur (AB + MHG GAs combined) the revised plan would reduce the amount of area that is suitable for timber production from approximately 14 percent under existing plans to approximately 12 percent, leaving the vast majority of the landscape in areas not suitable for timber production. Table 29 shows the estimated percent of Custer Gallatin lands suitable for timber production in areas currently known to be occupied by grizzly bears.

Table 29. Timber Suitability within Grizzly Bear Distribution Area (AB+MHG GAs)

	Existing Plans	Revised Plan
Inside Recovery Zone	11%	9%
Outside Recovery Zone	17%	14%
Total Distribution Area	14%	12%

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 can also result in increased forage for bears and/or their prey species, when removal of forest canopy allows more sunlight to reach the ground, stimulating growth of grasses, forbs and shrubs. Timber harvest may also occur outside the suitable base, but only for resource management needs other than timber production. Such purposes might include vegetation restoration, fuel reduction, wildlife habitat improvement, or other resource management. 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 and recommended wilderness areas, are not suitable for timber harvest for any purpose. Other areas such as the backcountry areas and key linkage areas allow timber harvest for limited resource reasons, primarily for restoration purposes, with a general focus on maintaining or restoring ecological integrity. 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.

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. Timber harvest could 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. Timber harvest could also be used to maintain or restore aspen or create openings, to benefit grizzly bear prey species such as elk and bison, or to maintain or restore whitebark pine, which is a key food source for grizzly bears.

Effects from Land Allocations

Designated areas such as wilderness, wilderness study areas, and inventoried roadless areas are created by authorities outside of forest planning and are not expected to change under the revised plan. However, the plan would impose additional land use allocations within the existing wilderness study area and much of the existing inventoried roadless areas across the Forest, thereby perpetuating generally protective land management strategies in these areas, and sometimes imposing added restrictions. For example, new energy/utility corridors, commercial communication sites, recreation events, and extraction of saleable mineral materials, would not be allowed in forest plan allocations of recommended wilderness or backcountry areas under the revised plan (FW-STD-RWA 02-06; FW-STD-BCA 01-06), whereas some or all of these activities could occur in the wilderness study area or inventoried roadless areas, if they could be accomplished without the need for new road construction.

Recommended wilderness areas would not be suitable for timber harvest for any purpose (FW-SUIT-RWA 01), whereas timber harvest would be allowed for fuel reduction or ecological restoration in backcountry areas (FW-SUIT-BCA 01), allowing more flexibility than recommended wilderness for restoration efforts to improve grizzly bear habitat, such as mechanical treatment to restore whitebark pine. Certain types of timber harvest are allowed for a variety of reasons within the wilderness study area and in inventoried roadless areas, so long as no new road construction is required. Recommended wilderness areas would not be suitable for permitted livestock grazing in areas where it is not currently

allowed (FW-SUIT-RWA 05), whereas new livestock allotments are not prohibited in backcountry areas, or inventoried roadless areas.

Motorized and mechanized use would not be allowed in recommended wilderness (FW-SUIT-RWA 02). Most backcountry areas in the grizzly bear distribution area would not allow summer or winter motorized recreation (AB-SUIT-BCBCA 01, MG-SUIT-CHBCA 01, MG-SUIT-LHBCA 01, MG-SUIT-WPBCA 01). The exception is in the Buffalo Horn Backcountry Area, where motorized recreation use would be allowed on existing system trails and winter use areas where motorized use is currently allowed (MG-SUIT-BHBCA 01). Most backcountry areas would allow mechanized use, but would restrict mountain bikes to system trails where such use is currently allowed (AB-SUIT-BCBCA 01, MG-SUIT-CHBCA 01, MG-SUIT-LHBCA 01). Recommended wilderness areas would not be suitable for rental cabins (FW-SUIT-RWA 06) and one such cabin, Windy Pass cabin, which is in the wilderness study area and inventoried roadless area, would come off the public rental program, and be available for administrative use only. Collectively, added restrictions associated with forest plan allocations of recommended wilderness and backcountry area, are generally more restrictive than existing land uses allowed in wilderness study areas and inventoried roadless areas, in ways that could benefit grizzly bears both within and outside the recovery zone, due to lower human disturbance effects to grizzly bears in these areas. Table 27 shows proportions of the AB and MHG GAs (combined) that fall within designated areas and forest plan allocations with protective measures.

Effects from Recreation Management

Recreation emphasis areas are forest plan allocations that typically offer a variety of recreation opportunities, including motorized and nonmotorized uses. These areas may be regional, national, or international destinations, and are often 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. Grizzly bear direction in the revised plan (FW-STD-WLGB 01-05) would limit the amount of new development added to recreation emphasis areas inside the recovery zone, except where they overlap with designated site footprints or primary road buffers. However, outside the recovery zone, new roads, trails and developed sites could be added in recreation emphasis areas, which could accommodate and/or attract even more human use. Additional human use in recreation emphasis areas could increase human disturbance levels, which could displace some bears from otherwise suitable habitat. However, recreation emphasis areas are located in areas that already receive high levels of human use, and are likely already avoided by wary bears. Management focus on recreation in these areas would continue to concentrate human use, rather than encouraging recreationists to disperse over larger areas. Unmanaged dispersed use could increase the potential for grizzly bear-human conflicts over the broader landscape. The revised plan identifies recreation emphasis areas both inside and outside of the grizzly bear recovery zone. All primary road segments along which new developed sites could be added, are located within recreation emphasis areas in the revised plan.

Other recreation emphasis areas inside the recovery zone emphasize winter use. These areas include the Hebgen Lake Basin, and area around Cooke City, which both receive high levels of recreation use year-round. However, these are destination areas for winter use on the Custer Gallatin, where snowmobile use has been popular for many years, facilities are already in place and human use is already concentrated. Therefore, effects of recreation emphasis area allocations are not expected to increase notably from existing conditions, and could help to manage potential grizzly bear-human conflicts by concentrating human use in areas and ways that are predictable to bears, and can therefore

be avoided. Winter use is expected to have limited impacts to grizzly bears since most of the associated human use would occur when grizzly bears are denning.

Podruzny and others (2002) looked specifically at potential conflicts between snowmobile use and grizzly bear den sites on the Gallatin portion of the Forest, which includes the winter recreation emphasis areas inside the recovery zone as well as other suitable denning habitat. 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. There is limited information regarding the effects of winter recreation on grizzly bears. However, there is evidence that human disturbance near an occupied grizzly bear den site may result in den abandonment, with potential adverse effects to the bear due to increased energy expenditures during a vulnerable time. This may be particularly stressful for females, since cubs are born in the winter dens, and den abandonment could result in loss of cubs (Fortin et al. 2016).

On the other hand, there is evidence of high tolerance to disturbance from snowmobile use at a den site occupied by a reproductive female grizzly bear in the Greater Yellowstone Ecosystem, with no obvious negative impacts to the sow or her cub (Hegg et al. 2010). Grizzly bears tend to select den sites in remote locations where human occupation and use is relatively low, but den site location may be more related to elevations and slopes that produce stable snow conditions for adequate insulation, rather than avoidance of humans per se (Linnell et al. 2000). This conclusion is supported by the selection of a den site by a reproductive female grizzly within 500 meters of a state highway in the Greater Yellowstone Ecosystem (Hegg et al. 2010). Winter logging operations could also potentially have disturbance impacts on denning grizzly bears (Linnell et al. 2000). This factor may be tempered by economic and safety reasons, as road plowing is costly and winter logging/hauling can be hazardous. Although winter recreation use or resource management near a grizzly bear den site could negatively affect bears at the site, human use near known grizzly bear den sites is monitored under the conservation strategy, with no evidence of den abandonment or grizzly bear-human conflict as yet on the Custer Gallatin National Forest (Montana FWP 2013, Haroldson 2019, unpublished).

In accordance with the conservation strategy, the revised plan stipulates that where otherwise allowed (e.g. outside of designated wilderness) non-wheeled over snow use is suitable in otherwise secure habitat for grizzly bears during the winter denning season, unless such use results in grizzly bear den abandonment, bear-human conflicts shortly after den emergence, or new research identifies a threat (FW-SUIT-WLGB 01). Therefore, while the revised plan would allow such use to continue, monitoring will also continue, and the plan would provide a mechanism for appropriate response should conflicts between denning bears and winter human use become an issue.

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 would require mitigation for effects from new access or developed sites related to mineral development inside the recovery zone (FW-STD-WLGB 02f). Outside the recovery zone, new minerals and energy developments would have fewer restrictions; however the revised plan includes desired conditions to restore site productivity following mineral activities (FW-DC-EMIN 01), and include standards for reclamation to achieve the desired condition (FW-STD-EMIN 01). These plan components indicate that energy and mineral management effects would be temporary, and eventually areas affected would be 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 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 (see previous discussion relative to secure habitat). Beyond the grizzly bear direction, the revised plan contains specific plan components for infrastructure including a desired condition that the Forest transportation system has minimal impacts on threatened species (FW-DC-RT 01). The revised plan also contains guidelines for colocation of infrastructure where possible, use of available technology to reduce resource impacts (FW-GDL-RT 01, 02), and standards for avoidance or minimization of impacts to water quality and riparian and wetland habitats (FW-STD-RT 01-05).

The Forest manages hundreds of miles of system trails in areas occupied by grizzly bears. Human presence, including motorized and non-motorized use, may have disturbance impacts on grizzly bears, potentially causing bears to underutilize otherwise suitable habitats. Also, there is potential for bear-human conflicts that may result from encounters between bears and humans along trails. Such conflicts can result in direct mortality of grizzly bears through human defense of life, or indirect mortality if subsequent management actions result in removal of the offending bear(s) from the wild. Mountain bike use on Forest system trails and potential for associated bear-human conflicts is an emerging concern. Research has shown that mountain bike use can impact wildlife, particularly since people on bikes can move more quickly than non-mechanized travel, and more quietly than motorized travel, resulting in higher potential for a surprise encounter with grizzly bears (Quinn and Chernoff 2010). Mountain bike use, like many other forms of recreation, is increasing in many parts of the Custer Gallatin, including areas currently occupied by grizzly bears. In the past two decades, there have been two reported incidents of surprise encounters between mountain bikers and grizzly bears on the Custer Gallatin that resulted in minor injuries to the bikers, with no known injuries or subsequent management actions for the bears involved (K. Frey, pers. comm. 2020). The revised plan encourages bear awareness information dissemination to forest users, aimed at reducing bear-human conflicts (FW-DC-WLGB 03). Mountain bike use is not allowed in designated wilderness, and would not be allowed in recommended wilderness in the revised plan (FW-SUIT-RWA 02), which would limit potential for bear-biker conflicts in about 53 percent of the area where grizzly bears currently occur on the Forest. Under the revised plan, mountain bike use would be restricted to approved system trails in backcountry areas and key linkage areas (AB-SUIT-BCBCA 01, MG-SUIT-CHBCA 01, MG-SUIT-LHBCA 01, FW-SUIT-WL 01), which would limit mountain bike use of user-created routes in those areas.

The revised plan indicates that backcountry aircraft landing strips are not suitable inside the grizzly bear recovery zone (FW-SUIT-AIRFIELDS 01), which would benefit grizzly bears within the recovery zone, by effectively limiting noise and disturbance associated with aircraft landing or takeoff. In the revised plan, direction for roads, trails, facilities and aircraft are complimentary to the grizzly bear direction, by requiring consideration for threatened species (FW-DC-RT 01), which would serve to address impacts to grizzly bears both within and outside the grizzly bear recovery zone.

Cumulative Effects

Land management plans for state and private lands within and adjacent to the Custer Gallatin National Forest boundary could have cumulative effects with proposed direction for the Custer Gallatin National Forest. Montana, Idaho and Wyoming have incorporated regulatory mechanisms for consistency with demographic criteria in the Grizzly Bear Recovery Plan (USDI FWS 2017a). 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.

Grizzly bears are considered a species of greatest conservation need by the State of Montana. The state wildlife action plan (Montana FWP 2015) identifies conservation measures to maintain connectivity among and between grizzly populations, support land purchases or conservation easements to protect important habitats, maintain road densities at or below current levels, and expand educational efforts to reduce grizzly bear conflicts with humans and domestic livestock. The Grizzly Bear Management Plan for Southwest Montana (Montana FWP 2013) contains goals to manage for a recovered grizzly bear population in southwestern Montana by ensuring long-term viability of grizzly bears and avoid the need to relist the species once it is removed from protection under the Endangered Species Act. This plan aims to allow for grizzly bear distribution in areas that are biologically suitable and socially acceptable, and to eventually manage the grizzly bear as a game animal including regulated hunting when and where appropriate. Guidance within the state management plan is based upon, and consistent with standards and guidance provided in the Conservation Strategy for Grizzly Bears in the Greater Yellowstone Ecosystem.

In recent years, the leading causes of grizzly bear mortality in southwest Montana have been backcountry encounters with humans, most notably big game hunters, and management removals associated with grizzly bear depredation on livestock on private land (Frey and Smith *in* van Manen et al. 2019). The state of Montana has hunter education programs to inform big game hunters how to minimize potential conflicts with grizzly bears in the field, and to help black bear hunters distinguish between grizzly bears and black bears in order to minimize potential for grizzly bear mortality due to mistaken identity. State wildlife biologists and game wardens also help enforce food storage orders to minimize potential bear-human conflicts. State agency personnel also work directly with livestock producers to implement measures to reduce the risk of grizzly bear depredations on livestock and subsequent management related removals of grizzly bears. State personnel were also instrumental in working with some counties in southwest Montana to establish proper food storage measures on private lands.

Non-governmental organizations have also been involved in providing public education about living with grizzly bears, contributing to sanitation measures (e.g. bear-proof dumpsters and food storage containers on public and private lands), and working with willing permittees to retire domestic livestock grazing allotments in grizzly bear habitat.

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 event 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.

Forestry management on state and private lands can affect grizzly bears by altering habitat and causing noise disturbance, but primarily through reductions in secure habitat associated with new road construction for accessing timber. There is only one section of state trust land inside the CGNF boundary that is managed for timber production and it is located well outside the grizzly bear recovery zone. Inside the recovery zone, state-owned lands are in wildlife management areas, where species conservation is the highest management priority. The City of Bozeman owns several (5+) sections of land outside the recovery zone, but within grizzly bear distribution, and these lands are primarily managed for municipal water resources. Forestry management on city lands may also affect grizzly bears through habitat alteration, disturbance factors, and road construction.

Human population growth is increasing at a dramatic rate in the Greater Yellowstone Area, including communities within and near the Custer Gallatin National Forest. Large-scale permanent developments to accommodate human population growth could occur on non-federal lands, with associated potential for adverse effects on grizzly bears and their habitats. All Montana Counties overlapping grizzly bear distribution in southwest Montana have growth policies in place, most of which contain goals to protect important wildlife habitats, while providing safety for residents and protecting economic interests. County growth policies are not regulatory and therefore would not preclude or restrict residential or commercial development on private lands, but may impose mitigation measures through subdivision review and approval processes.

Conclusion

Generally speaking, the revised plan would focus more on ecological processes and strive to maintain habitat conditions within the natural range of variation, to which native species have evolved. The revised plan includes detailed and explicit management direction that would protect water quality and associated riparian habitat, protect and restore whitebark pine, and maintain functionality of big game habitat, including proactive measures to increase bison presence on the Forest. New forest plan allocations for recommended wilderness, backcountry areas, and key linkage areas would formalize long-term protections in much of the area currently occupied by grizzlies, as well as providing for long-term habitat connectivity to promote interchange between grizzly bear ecosystems. The revised plan would also require continuance of a special order for proper storage of food and attractants in all areas where grizzly bears may be expected to occur on the Forest throughout the life of the plan. Further, the revised plan would formally restrict grazing of domestic sheep and goats on NFS lands, not only inside the recovery zone as currently required, but outside the recovery zone in areas currently occupied by grizzly bears, as well as areas that may be important for grizzly bear dispersal. By adopting habitat management recommendations from the GYE conservation strategy, the revised plan would continue to focus on key factors of secure habitat, developed sites, and domestic livestock management, in a manner consistent with the Grizzly Bear Recovery Plan (USDI FWS. 1993, as amended 2007). In these ways, the revised plan goes further than existing plans to protect important habitat components for grizzly bears and manage human uses in a way that is compatible with grizzly bear recovery. However, the revised plan would continue to support a multiple use mandate by incorporating measures to sustain resource extraction, domestic livestock grazing, and public recreation, all of which could result in disturbance, displacement or human-caused mortality of individual bears.

Determination of Effects

Implementation of the proposed action ***may affect, and is likely to adversely affect grizzly bears*** on the Custer Gallatin National Forest for the following reasons:

Baseline secure habitat values are relatively low in the Henry's Lake #2 and Madison #2 Bear Management Subunits. While implementation of the revised plan would require long-term maintenance of secure habitat in these subunits, temporary reductions in secure habitat would be allowed below the new baseline levels achieved through full implementation of the Gallatin Forest Travel Management Plan (USDA 2006b). Lower baseline levels are likely resulting in grizzly bear avoidance of otherwise suitable habitats in these areas, and potential for temporary reductions in secure habitat in these subunits could cause additional disturbance and potential displacement of grizzly bears in the area, which could have localized adverse effects on individual bears.

The revised plan would allow for temporary reductions of secure habitat below baseline levels inside the recovery zone, and there could also be temporary or permanent reductions in secure habitat in subunits that are currently above baseline levels. Secure habitat levels are generally high inside the recovery zone, and temporary reductions in secure habitat below baseline levels would not affect more than 1 percent of the acres in the largest subunit of the affected Bear Management Unit. Larger reductions in secure habitat would be possible in subunits that are currently above baseline levels, which could cause disturbance and displacement of resident bears, resulting in localized adverse effects on individual bears. Secure habitat would be maintained at or above 1998 baseline levels inside the recovery zone.

There could be temporary as well as permanent reductions of secure habitat outside the recovery zone. Secure habitat levels are high in some, but not all, areas outside the recovery zone on the Forest. Large temporary or permanent reductions in secure habitat associated with road construction and/or permanent developments could result in habitat loss, disturbance and/or displacement of grizzly bears, as well as increased potential for bear-human conflicts, which would have localized adverse effects on individual grizzly bears. Reductions in secure habitat outside the recovery zone is not expected to result in more than 1 percent decrease in secure habitat due to new permanent roads, or more than 2 percent decrease in secure habitat due to new temporary and/or permanent roads in any single BAU over the life of the plan.

Compliance with travel management restrictions is generally good on the Custer Gallatin, with multiple monitoring mechanisms in place to address non-compliance issues. However, some minor breaches of motorized restrictions are expected to occur. Illegal motorized intrusions into otherwise secure grizzly bear habitat could temporarily displace bears due to noise disturbance. Such infractions occur infrequently relative to legal use, are dealt with immediately when brought to Forest Service attention, and are most likely outside the recovery zone where motorized access is more readily available. Therefore, illegal motorized use would have insignificant effects on grizzly bears.

The revised plan would adopt a "footprint approach" to managing and monitoring larger developed sites, which would allow for unmitigated expansion of visitor capacity in some areas, while also allowing for additional developed site construction within a 300 meter buffer of primary roads, as well as to address resource issues associated with uncontrolled dispersed use. These factors would relax restrictions that have been in place since 2006, allowing for additional human use at some developed sites. The areas affected are minute relative to the landscape scale used by bears, and these adjustments would serve to concentrate human use in areas where bears have learned to expect and/or avoid it. Therefore, while such changes could produce added disturbance impacts for bears in the vicinity, increased human capacity at existing areas of concentrated human use would have insignificant effects on grizzly bears.

Aside from reductions in secure habitat, implementation of the revised plan could result in habitat modification and disturbance or displacement associated with noise and human presence related to vegetation management projects, construction of new permanent developments for recreation and/or administrative purposes, or mineral and energy exploration and/or development. Such activities could have localized adverse effects on individual grizzly bears in close proximity to projects.

Finally, human-caused grizzly bear mortalities could result from increased human access in some areas, surprise encounters between bears and humans in the back-country, grizzly bear attraction to human food sources, and/or livestock grazing practices. Any human-caused grizzly bear mortality associated with management actions implementing the revised forest plan would have adverse effects on grizzly bears.

Wolverine

Species status and ecological information

Population status and distribution

The U.S. Fish and Wildlife Service (USFWS) proposed to list the Distinct Population Segment (DPS) of the North American wolverine (*Gulo gulo luscus*) in the contiguous United States as a threatened species in 2013 (USDI 2013a). After receiving peer review and public comments, the FWS withdrew the proposal in 2014, concluding that the factors identified in the proposed rule were not as significant as believed earlier. In 2016, the US District Court in Montana vacated the withdrawal and remanded the matter back to the USFWS for further consideration. This effectively reverted the status of wolverine back to proposed as threatened in the contiguous US (USDI FWS, 2016b). Critical habitat has not been proposed for wolverines in the contiguous U.S.

The contiguous US is the southern extent of the wolverine's range in North America. There are two main population centers located in the Northern Rocky Mountains and the North Cascades. Current known distribution is limited to north-central Washington, the Willaheeta Mountains of Oregon, northern and central Idaho, western Montana and northwestern Wyoming. The bulk of the population occurs in the northern Rocky Mountains, likely as a metapopulation, with intermittent exchange of individuals among semi-isolated subpopulations in some of the peripheral island mountain ranges. Historical records suggest wolverine populations previously existed in parts of the southern Rocky Mountains (Colorado) and the Sierra Nevada Mountains, but these were likely extirpated during predator control campaigns in the early 1900's. Occasionally, individual wolverines are reported in these areas, but there is no evidence that these are more than just dispersing males, or that reproduction is occurring (USDI FWS, 2013a).

Wolverine occurrence in the continental United States has been documented back to 1801. The species was extirpated, or nearly so, from the continental United States by the 1930s, primarily due to unregulated trapping and predator control (Aubry et al. 2007), populations then rebounded in the second half of the 20th century as intense predator control efforts subsided (USDI FWS 2013a). Wolverines naturally occur at low densities relative to other mammals, and reside in remote areas and harsh environments, making them difficult to survey or monitor. As a result, current population levels and trends are unknown; however, based on the extent of occupied habitat and knowledge of wolverine densities, it was estimated in 2013 that roughly 250 to 300 wolverines existed in the contiguous U.S (USDI FWS 2013a). Given naturally fragmented habitat for wolverines at the southern extent of their

range, coupled with the species' apparent natural propensity for remote, harsh and unproductive environments, it is likely that historical wolverine populations also occurred at low densities with associated low overall numbers (Aubry et al. 2007).

Habitat requirements and life history relevant to conferencing

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, McKelvey et al 2011, and Fisher et al. 2013). As a result of this natural habitat patchiness, wolverine populations occur at lower densities in the continental United States (Ruggiero et al. 2007). 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 summer temperatures. Although wolverines are 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.

Habitat conditions selected by wolverines typically occur in areas far from human development, and are frequently located in protected areas, such as designated wilderness. As such, habitats occupied by wolverines tend to be relatively undisturbed by human development. However, the metapopulation structure requires genetic interchange between isolated subpopulations, which may require wolverines to travel across less suitable habitats with higher levels of human development (USDI FWS 2013a). Wolverine 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 (USDI FWS 2013a, McKelvey and Buotte in 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.

Due to the harsh conditions and low productivity of high elevation habitats, wolverines tend to have large home ranges and low reproductive rates. However, they are food generalists, preying on a variety of small animals, scavenging carrion, and consuming fruits, berries, and invertebrates (Banci, 1994; Hornocker & Hash, 1981). There is a high degree of territoriality between individuals of the same sex. This territoriality combined with large territory size requires long range movements to access resources.

Environmental Baseline

Population status and distribution in the action area

Montana has historically been a stronghold for wolverines in the continental United States, but even here, there were no verifiable records of wolverines between 1921 and 1930. Early research suggests that wolverines dispersing from Canada began to recolonize in Montana between 1930 and 1950, while there were few if any verified records from other states until about 1960 (Aubry 2007). The Custer Gallatin National Forest supports wolverines in the Greater Yellowstone and Central Linkage Regions (see habitat description below) as described by Inman and associates (2013). These regions support a considerable proportion of wolverines found in the continental U.S. DPS. With an estimated 63 individuals in the Greater Yellowstone and about 50 animals in the Central Linkage Region (Ibid), these

two subpopulations could account for roughly a third to nearly one-half of the total estimated number of wolverines in the DPS.

The number of wolverines that occur on the Custer Gallatin is unknown. However, density estimates at the larger Greater Yellowstone landscape scale equate to roughly 3.5 wolverines per 1,000 km² (386 mi²) of suitable habitat (Inman et al. 2012). Based on criteria developed by Inman and associates (Ibid), the Custer Gallatin contains roughly 2,731 mi² of habitat suitable for residential occupation by wolverines. Accordingly, if suitable habitat on the Forest were fully occupied, one would expect approximately 25 wolverines to occur in the plan area.

Habitat conditions in the action area

Wolverine habitat is found in the montane ecosystem of the Custer Gallatin National Forest, and the species is known to occur in the Absaroka-Beartooth (AB), Madison Henrys Gallatin (MHG) and Bridger Bangtail Crazy (BBC) geographic areas (GA) (i.e. all montane GAs except for the Pryor Mountains) (table 30 and figure 17). Wolverines present in the AB and MHG GA are part of the Greater Yellowstone subpopulation. These GAs contain large, contiguous blocks of high elevation habitat with persistent spring snow, and low levels of human disturbance. The GYE has been identified as one area in the continental U.S. that is predicted to experience less snow loss due to climate change than other areas at lower elevations (McKelvey et al. 2011, Halofsky et al. 2018b).

Another important area for wolverines has been coined the “Central Linkage Region” (CLR) by Inman and associates (2013). This region includes the BBC GA of the Forest, which could be highly important for wolverine metapopulation persistence. 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 CLR is roughly the same scale as the GYE for wolverines, but habitat is much more patchily distributed, with habitat primarily occurring 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. 2012). The Pryor Mountain GA has some, albeit very marginal quality wolverine habitat. This is the only GA in the montane ecosystem for which wolverine presence has not been documented. The quantity of potential habitat is likely not enough to support a resident individual’s home range and seasonal forage needs (table 30). While overall habitat suitability and quantity in the Pryor Mountain GA may be low for wolverines, this GA may serve as dispersal habitat, primarily for male wolverines (Inman et al. 2013; also see figure 17). This landscape could potentially connect the Big Horn Mountains in Wyoming with occupied habitats to the north and west.

Wolverines on the Custer Gallatin and surrounding areas show the 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). 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 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. 2012).

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 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 17).

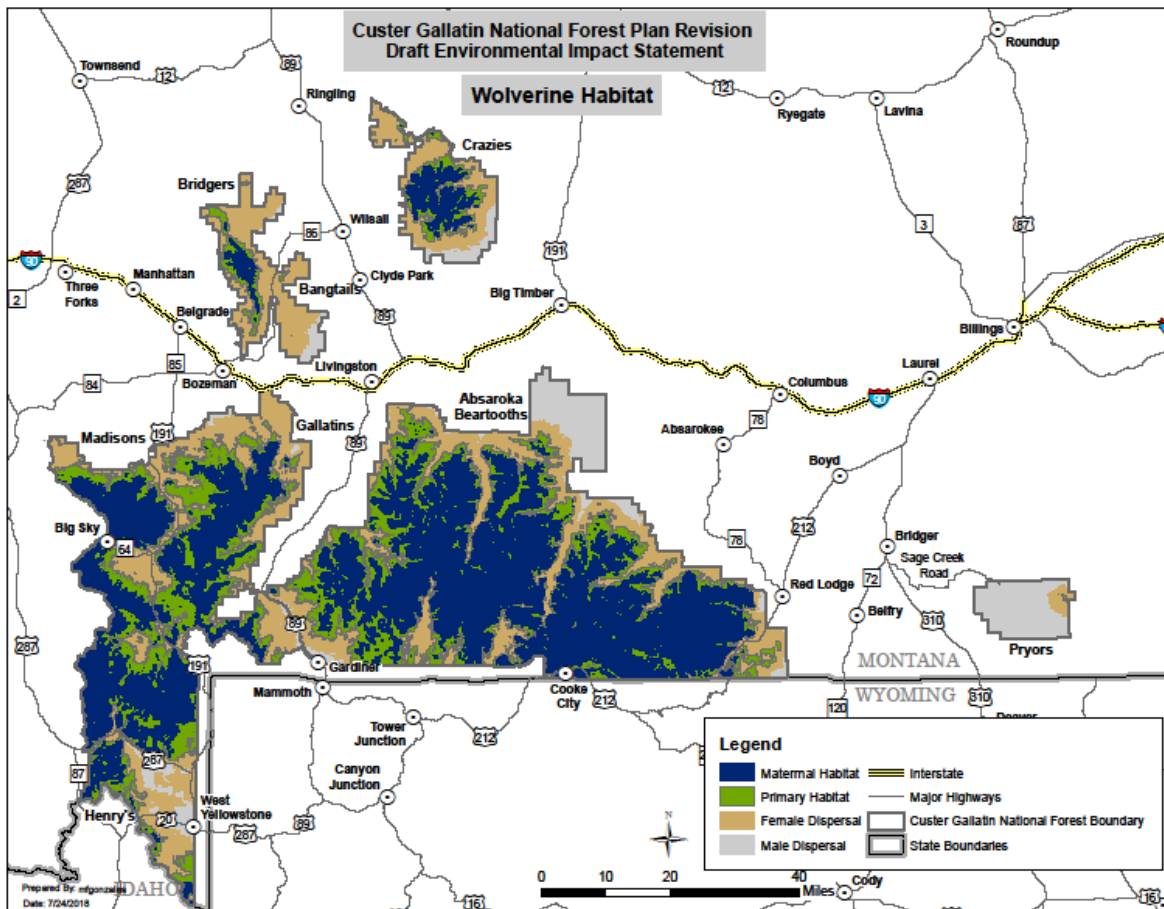


Figure 17. Wolverine Habitat within the Custer Gallatin National Forest Planning Area

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 speaking, these categories included habitat that is suitable for wolverine reproduction, survival and/or 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 also 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 used 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. Wolverine habitat categories as described by Inman and associates (2013) are shown for the Custer Gallatin in figure 17. Table 30 shows the proportions of various wolverine habitat components by Custer Gallatin geographic areas, and broken out for the different wolverine subpopulations (Greater Yellowstone and Central Linkage Regions).

Table 30. Wolverine Habitat Summary NFS Acres

Geographic Area Size in acres	Persistent Snow¹	Maternal Habitat²	Primary Habitat²	Female Dispersal²	Male Dispersal²
AB + MHG: GYRegion 2,165,156	1,490,766 69%	895,210 41%	1,582,434 73%	2,031,600 94%	2,165,033 100%
BBC: Cntrl Link Reg 205,148	118,537 58%	29,668 14%	81,113 40%	183,629 90%	205,148 100%
Pryor Mountains 75,067	14,982 20%	0 0%	391 <1%	7,391 10%	75,067 100%
Total in Plan Area 2,445,371	1,624,284 66%	924,878 38%	1,663,938 68%	2,222,620 91%	2,445,248 100%

Sources: ¹Copeland et al. 2010 defined as snow cover during the spring period 6 out of 7 years, ²Inman 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 (NFS lands) is within designated wilderness, with an additional 28% in inventoried roadless area, for a total of 95% 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% in wilderness, and an additional 32% in inventoried roadless areas, for a total of 89% of primary habitat.

Effects of the Revised Plan on Wolverine

Management Direction under the Revised Plan

Similar to the current plans, the proposed plan includes a desired condition that habitat contribute to species recovery needs and that population trends of listed species are stable or increasing across their range (FW-DC-WL 02). In addition, the proposed plan contains 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 (FW-DC-WL 03, 07). The proposed plan also includes 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 (FW-DC-WLWV 01). A guideline in the revised plan would provide secure habitat for reproductive wolverines by limiting special use authorizations and designation of winter routes in maternal habitat during the reproductive season (FW-GDL-WLWV 01). Finally, the proposed plan implements a key linkage area concept, with plan components that limit management actions in designated key linkage areas (FW-GDL-WL 05).

Effects of the Revised Plan

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 2013a). Plan components in the proposed plan would reduce potential for human disturbance in maternal habitat relative to the current plans.

Effects from Terrestrial Vegetation Management

The proposed plan includes 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 (FW-DC-VEGF 01, 02, 03, 04, 07; FW-DC-VEGNF 01, 04). 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 (FW-DC-WL 03). Collectively, plan direction for vegetation management under the proposed plan contributes 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 (FW-DC-VEGF 04).

Given the association with high elevation, cold, rugged landscapes suitable wolverine habitat can overlap with existing whitebark pine habitat on the Custer Gallatin. The revised plan proposes 1,000 acres of restoration activities with the purpose of increasing the health of whitebark on the Forest (FW-OBJ-PRISK 02). Actions that occur within whitebark habitat may result in the temporary avoidance or displacement of individual wolverines during project implementation. While temporary impact to wolverine may occur maintenance of whitebark pine promotes community diversity and stability in high mountain ecosystems (FW-DC-PRISK 02). The retention of community diversity and ecosystem health through restoration actions represents a long term benefit to wolverines and their habitats. In addition, the small scale of proposed whitebark restoration, 1,000 acres over ten years, represents a negligible and easily avoidable effect given the size of wolverine home ranges.

Effects from Timber Management

There is little documentation of effects to wolverines from land management actions such as timber harvest (USDI FWS 2013a). Forest management actions that reduce or remove vegetation cover, such as timber harvest and associated road construction, can impact soil temperature, snow interception and retention of snowpack (Luce 2018 *in* Halofsky et al. 2018a). Research on wolverine habitat use in British Columbia, Canada by Krebs et al. (2007) demonstrated that summer habitat use by females was positively associated with roadless areas and negatively associated with recently logged areas suggesting some level of disturbance avoidance. In Alberta, Canada Fisher et al. (2013) determined the probability of wolverine occurrence decreased across a gradient of increasing anthropogenic landscape development. Noise from equipment and human presence associated with timber harvest can also have disturbance effects on wolverines, possibly resulting in displacement from suitable habitat, or behavioral modifications that could affect a wolverine's energy reserves. However, timber harvest 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 removal for timber production is less likely to occur. Finally, a large proportion of maternal and primary wolverine habitat is

in designated wilderness areas where timber harvest is not allowed, or in inventoried roadless areas, where timber harvest would be allowed under limited circumstances, including no road-building. In addition, wolverines are not thought to be highly dependent on specific vegetation and habitat features potentially influenced by management actions. As such these management actions are unlikely to represent a threat to the conservation of the species (USDI FWS 2013a).

Under the revised plan, timber harvest for purposes of timber production would be allowed only on those lands classified as suitable for timber production (FW-STD-TIM 01). The proportion of the montane ecosystem classified as suitable for timber production in the proposed plan is 13 percent. The suitable timber base is generally located at lower elevations, where highly productive soils produce more and larger trees than the higher elevations typically occupied by wolverines. Therefore, timber harvest is unlikely to have a notable impact on vegetation that contributes to persistent spring snow cover in maternal or primary wolverine habitat, and also unlikely to occur in areas where disturbance associated factors would have a notable impact on wolverines. Timber harvest could affect dispersal habitat for wolverines through habitat alterations and possible disturbance effects. Given that wolverines have the capacity to disperse widely, fragmentation of habitat may not be synonymous with any barrier effect (Fisher et al. 2013).

Effects from Fire and Fuels Management

The proposed plan contains 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 (FW-DC-FIRE 01). Guidelines for use of minimum impact fire suppression tactics to avoid resource damage, including negative impacts to habitat for at-risk species (FW-GDL-FIRE 02, 03). Predicted climate trends call for warmer temperatures and less precipitation than historical conditions, likely resulting in larger fires over longer burning seasons. The proposed plan incorporates 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. 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 and resiliency to potential changes in fire patterns associated with climate change.

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 (FW-DC-FIRE 02). These areas would be managed to maintain vegetation conditions to support only low-intensity fires. The proposed plan includes objectives for hazardous fuel mitigation in wildland urban interface (WUI) areas as well as for ecological restoration and maintenance in other areas (FW-OBJ-FIRE 01; FW-DC-FIRE 02; FW-GDL-FIRE 03). Management actions that reduce or remove vegetation cover, including fuel reduction and prescribed fire, can impact soil temperature, snow interception and retention of snowpack (Luce 2018 *in* Halofsky et al. 2018a). 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 2013a, Fisher et al. 2013), there is little overlap between wolverine primary range and WUI, so fire and fuels management focused in WUI areas would have little effect on wolverines. There is little evidence to indicate that land management actions that result in the manipulation of habitat represent a threat to the conservation of the species (USDI FWS 2013a).

Effects from Carbon Storage and Sequestration Management

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 2013a). In the proposed plan 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. Therefore, land management actions are very unlikely to have a notable impact on climate change. The proposed plan contains 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 (FW-DC-CARB 01).

Plan components explicitly provide for ecosystem resiliency, and acknowledge carbon storage as an important function of National Forest System lands (FW-DC-SUS 03). Plan components emphasize resilience in desired conditions for multiple resources (FW-DC-WTR 01; RMZ 01; VEGF 02, 03, 04, 09; VEGNF 04; FIRE 01; CARB 01; WL 06; RECSUP 04; RNA 02), and include standards and guidelines (FW-STD-GRAZ 01; FW-STD-TIM 08; FW-GDL-VEGF 01, 05) as proactive measures to improve ecosystem resilience relative to predicted changing climates. Collectively, these components in the revised plan would ensure that potential impacts of climate change are considerations for projects that could affect wolverine habitat, which would promote more proactive mitigation for possible impacts to wolverine habitat compared to the current plans.

Effects from Land Allocations

Table 31. Proportion of wolverine habitat types overlapping revised plan land designations – All ownership.

Habitat Type	RWA ¹	BCA ¹	REA ¹	KLA ¹	IRA ¹	Wild ¹	WSA ¹
Maternal	7%	3%	2%	<1%	14%	65%	2%
Primary	5%	5%	3%	<1%	18%	54%	1%
Persistent Snow	5%	5%	3%	<1%	17%	54%	1%

¹RWA: Recommended Wilderness Area, BCA: Backcountry Area, REA: Recreation Emphasis Area, KLA: Key Linkage Area, IRA: Inventoried Roadless Area, Wild: Wilderness, WSA: Wilderness Study Area

Proposed land use allocations were analyzed from the perspective of three key mapped wolverine habitat types maternal, primary, and persistent snow cover (table 31). The majority of all three habitat types are contained within existing designations for Wilderness and Inventory Roadless (IRA) and Wilderness Study Areas (WSA). These designations provide habitat protections by limiting the type and scope of potentially disturbing and habitat altering activities. The integrity of existing habitat conditions and use patterns by wolverines are likely to be retained in portions of habitat that fall within existing land use designations. In addition to existing land use designations the proposed Forest Plan established four additional land allocation categories; recommended wilderness area, backcountry areas, recreation emphasis areas, and key linkage area. In the unlikely event that congress repeals Wilderness and Roadless designations the land allocation categories established in the revised plan and the protections provided would remain valid and in effect.

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. There are seven recommended wilderness area in the proposed plan. Between five and seven percent of mapped wolverine habitats is located within proposed recommended wilderness areas (table 31).

Much of the recommended wilderness area in the proposed plan is within current wilderness study areas or inventoried roadless areas. The plan would provide added security from human disturbance for wolverines by adding a recommended wilderness allocation areas thereby increasing the number of land management restrictions for new structures, removal of saleable minerals, new recreation events, new recreational motorized and mechanized means of transport (FW-STD-RWA 01-06). The major implication for wolverines would be that motorized over snow recreation would not be a suitable use in designated recommended wilderness areas (FW-SUIT-RWA 02). Research has documented indirect habitat loss through avoidance behavior by wolverines towards motorized recreation such as snowmobiles during the winter season (Heinemeyer et.al. 2019). A reduction in potential acres of allowable motorized over the snow recreation relative to the current plans could reduce indirect habitat loss and represent a positive benefit to wolverines conserving habitat use patterns.

A total of thirteen backcountry areas are in the proposed plan nine of which would occur within geographic areas containing suitable wolverine habitat. Backcountry areas are generally small relative to wolverine habitat. Between three and five percent of mapped wolverine habitats are located within proposed backcountry areas (table 31). As with recommended wilderness, backcountry areas often spatially overlap with inventory roadless areas, limiting certain types of human use. The desired condition for backcountry areas is to limit permanent long lasting evidence of human use and allow natural processes to play their role (FW-DC-BCA 01) 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, saleable mineral removal, and new developed recreation sites (FW-STD-BCA 01-05). However, land uses are less restricted in backcountry areas than in recommended wilderness areas.

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. No new permanent roads shall be constructed in any of the propose backcountry areas. All but two of the backcountry areas restrict construction of temporary roads as well (PR-STD-PBCA 01; AB-STD-BCBCA 01; BC-STD-BPBCA 01; BC-STD-CMBCA 01; MG-STD-BHBCA 01; MG-STD-CHBCA 01; MG-STD-LHBCA 01; MG-STD-WPBCA 01). In the Big Pryor and Punch Bowl backcountry areas temporary road construction is allowed (PR-STD-PBCA 01). The construction of temporary roads within these two backcountry areas will have limited impact on wolverine habitat given the low quantity of suitable habitat in the Pryor Mountains geographic area. With the exception of the Buffalo Horn, Big Pryor, and Punch Bowl, backcountry areas are not considered suitable for motorized use (AB-SUIT-BCBCA 01; BC-SUIT-BPBCA 01; BC-SUIT-CMBCA 01; MG-SUIT-CHBCA 01; MG-SUIT-LHBCA 01; MG-SUIT-WPBCA 01). Impacts of this motorized use restriction would be similar to those described for recommended wilderness areas.

Restricting motorized recreation would reduce the potential for wolverine indirect habitat loss through avoidance. In the Big Pryor, Punch Bowl, and Buffalo Horn backcountry areas, motorized over snow opportunity would not change from existing conditions. Only the Buffalo Horn is located in a geographic area where wolverines are documented as present. Wolverines may experience indirect habitat loss due

to motorized winter recreation within the Buffalo Horn backcountry area. Currently, dispersed recreational activities do not substantiate a threat to the continued existence of wolverine on the landscape (USDI FWS 2014a). Heinemeyer et.al. (2019) speculates the impact of backcountry recreation could increase under conditions where climate change has resulted in a concentration of winter recreational opportunities and wolverine habitat through reduction in available snow pack. Backcountry areas represent only a small portion of key wolverine seasonal habitats and restricting motorized recreation in a majority of these areas will result in the conservation of important habitat and maintenance of habitat functionality for wolverines.

All potential recreation emphasis areas are located in the montane geographic areas that contain potential 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. Only a small portion of wolverine habitat falls within proposed recreation emphasis areas (table 31). The proposed plan identifies two winter recreation emphasis areas. The Cooke City winter recreation emphasis area is roughly 24,000 acres, and includes both maternal and primary wolverine habitat. Hebgen winter recreation emphasis area is roughly 71,000 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. These areas are all close to human population centers or areas that are currently managed, and heavily used for winter recreation. Therefore, regardless of whether these areas receive forest plan allocation for winter recreation emphasis, winter use would likely remain at high levels. Research has documented indirect habitat loss through avoidance behavior by wolverines towards motorized recreation such as snowmobiles during the winter season (Heinemeyer et.al. 2019). The Hebgen winter recreation emphasis area is part of the area in which winter recreation effects on wolverines has been studied. Heinemeyer and associates (Ibid) 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.

The Bridger recreation emphasis area is roughly 13,000 acres and includes some primary and maternal wolverine habitat, as well as dispersal habitat. Existing allowed uses, including a developed alpine ski area, would not change due to forest plan allocation in this area, and the higher elevations containing most of the maternal habitat would remain closed to snowmobile use, but open to backcountry skiing. 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, so would only receive nonmotorized winter recreation. The 2014 Proposed Rule from USFWS indicates that dispersed recreational activities do not substantiate a threat to the continued existence of wolverine (USDI FWS 2014a). Plan components 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 (FW-GDL-REA 01).

While wolverines are certainly capable of long-distance dispersal, 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. The revised plan recognizes and addresses the importance of wildlife connectivity. Landscape patterns are intended to provide habitat connectivity for wildlife and facilitate daily and seasonal movements. The facilitation of long range dispersal will support genetic diversity and allow adaptation to changing conditions (FW-DC-WL 05). The key linkage area would minimize habitat loss due to construction of permanent facilities, and limit disturbance effects associated with larger-scale management actions in focal areas at the north end of the Gallatin Range and the west side of the Bridger Range (figure 2 and figure 4). 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. Within the key linkage area the intent is for human disturbance to not limit habitat connectivity for wildlife, particularly wide-ranging species (FW-DC-WL 07). This will be accomplished through a number of standards and guidelines that provide spatial and temporal protections to not preclude the movement of wildlife across the landscape (FW-STD-WL 02, FW-GDL-WL 01-05). While only a small portion of mapped wolverine habitat occurs within the key linkage areas (table 31) the Bridger Range is part of the Central Linkage Region identified by Inman and associates (2013) as an area of high importance for habitat connectivity and gene flow between the larger contiguous blocks of high quality wolverine habitat. This range is 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 the proposed plan, would provide more protection for potential wolverine dispersal routes. The remainder of the Gallatin Range would be under a variety of land designations and allocations that would maintain habitat connectivity for wildlife movement. Based on amounts and distribution of persistent snow cover, potential wolverine dispersal routes have been identified through the Crazy Mountains and the Madison Range (Schwartz et al. 2009a, McKelvey et al. 2011). These areas are not specifically identified as key linkage areas. 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 the proposed plan.

Effects from Permitted Livestock Grazing Management

There is limited information relative to wolverine conflicts with domestic livestock in North America, with little evidence of economic losses to livestock producers from this species. However, wolverines are capable of taking prey much larger than themselves, and it is possible that young livestock could be vulnerable to wolverine depredation. The vast majority of livestock grazing on the Custer Gallatin occurs on the Ashland and Sioux Geographic Areas, in the pine savanna ecosystem where wolverine do not occur. Livestock on NFS lands in the montane ecosystem are typically cattle or horses, and there is

limited overlap between livestock allotments and maternal or primary wolverine habitat on the Forest. Historic sheep allotments on the Custer Gallatin Forest had considerable overlap with wolverine habitat, and were located at generally higher elevations than cattle allotments. Wolverines have been known to prey on domestic sheep in Norway (Landa et al. 1999). Domestic sheep would not be established on grazing allotments within any of the Montane Geographic Areas (FW-STD-GRAZ 02), thereby precluding the presence of unattended domestic sheep in all areas of the Forest with wolverine habitat, which would minimize potential for conflicts between wolverines and domestic livestock.

Effects from Infrastructure, Roads, Trails, and Aircraft Landing Strip Management

Wolverine distribution is associated with remote high elevation, alpine, subalpine, or relatively cold locations, which has at times been correlated with avoidance of humans and human infrastructure. 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 2013a).

The proposed plan allows for potential construction and use of non-commercial recreational aircraft landing and take-off strips in certain areas (FW-STD-AIRFIELDS 01, FW-SUIT-AIRFIELDS 01). No such facilities currently exist. The revised plan does not formally establish new airfields or landing strips. All future locations would be addressed under the special use permit process (FW-STD-AIRFIELDS 02). The revised plan contains plan components that define locations not suitable for aircraft landing locations (FW-SUIT-AIRFIELDS 01). Locations would not be allowed within wilderness, wilderness study areas, wildlife management areas, national landmarks, and areas of non or semi motorized opportunities (FW-SUIT-AIRFIELDS 01). These restrictions would greatly limit any potential impacts to wolverine habitat. 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 would typically be in dispersal habitat, which would result in few notable impacts on wolverines. Finally, all aircraft landing strips would be authorized under a special use permit, and a wolverine guideline would preclude any such permits for winter use in maternal habitat (FW-GDL-WLWV 01).

Research has indicated a negative relationship between roads and wolverine occurrence (Carroll et al. 2001, Rowland et al. 2003). In British Columbia, Canada Krebs et al. (2007) demonstrated that summer habitat use by female wolverines was positively associated with roadless areas. In Alberta, Canada Fisher et al. (2013) determined the probability of wolverine occurrence decreased across a gradient of increasing anthropogenic landscape development. 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 and other anthropogenic development (Fisher et al. 2013). 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 2013a). 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.

The proposed plan includes desired conditions to provide a safe, efficient transportation system for public and administrative use, with minimal impacts on other resources, including at-risk species (FW-DC-RT 01). In order to minimize impacts, the plan includes components that encourage use of technologies that reduce impacts to other resources, and facilitate removal and restoration of roads and facilities no longer needed (FW-GDL-RT 01, 02).

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 2013a). 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. Plan components protect water quality and quantity, and protect other natural resources through proper location, design, and maintenance of administrative and recreation developed sites (FW-GDL-FAC 01-04; FW-DC-RECDEV 02, 06, 07, 09).

Effects from Recreation Management

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 BBC GA, and Red Lodge Mountain in the AB GA, as well as two Nordic areas, the Crosscut Mountain Sports Center in the BBC GA and the Lone Mountain Ranch in the MHG GA. 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.

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 the revised plan, snow compacting activities would be limited by lynx management direction (NRLMD Guideline HU G11), and the scale at which snow-compacting activities is expected to occur is small relative to a wolverine's home range size.

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 (Krebs et.al. 2007, Heinemeyer et al 2019). This is especially true for females and motorized recreation. The potential for this impact may increase if reduced snow pack associate with climate change results in the concentration of recreationists and wolverines in locations of persistent snow (Heinemeyer et.al. 2019).

The proposed rule (USDI FWS 2014a) recognizes the potential for localized small-scale effects from dispersed recreational activities such as snowmobiling, heli-skiing, hiking, biking, off and on-road motorized use, hunting, fishing, and other uses. According to scientific information currently available dispersed recreational activities may result in some localized small scale effects but do not substantiate a threat to wolverine and are therefore, not considered a threat to the DPS of the North American wolverine (Ibid). The revised plan includes multiple 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 (FW-DC-RECDEV 02, 06, 07 FW-DC-RECDISP 01).

Many of the predicted effects of climate change on snow amount, distribution and persistence, along with associated impacts on wolverines are uncertain (USDI FWS 2014a). 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. 2019). So, while portions 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 may result in increased disturbance impacts on wolverines. To address the impact of declining snowpack and increased recreation pressure recreation site locations and seasons will consider impacts of potential climate change to fish and wildlife habitats and patterns of seasonal recreational use in the proposed plan (FW-DC-RECDEV 09). In addition, to provide secure habitat for reproductive wolverines there would be no increase in special use authorizations or designations of winter routes in maternal habitat for wolverines during the reproductive season (FW-GDL-WLWV 01).

Developed ski areas on National Forest System lands are areas of concentrated winter recreation use are likely avoided by wolverines since wolverines tend to exhibit a strong avoidance response as intensity of human use increases (Heinemeyer et al. 2019). The four existing ski areas under special use permit on the Custer Gallatin National Forest could potentially be expanded under the revised plan, which would further reduce suitable winter habitat for a small number of wolverines with home ranges that overlap the ski areas. Expansion of existing permitted ski areas would be favored over development of new areas (FW-STD-RECSKI 01, FW-GDL-RECSKI 01, NRLMD Guideline HU G1, G2). 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 2018, 2019 pers. comm.). Therefore, fur trapping in general would present a negligible effect to wolverine populations in the plan area.

Effects from Minerals Management

The majority of mining activities on the Forest have occurred in the Stillwater Complex along the northern margins of the Beartooth Plateau in the northeast portion of the Absaroka-Beartooth Geographic Area. As such, the Stillwater Complex is identified as a separate land allocation for specific management direction due to its importance for mineral deposits. The Stillwater Complex allocation covers nearly 102,000 acres, including both primary (47%) and maternal (16%) wolverine habitat. While considerable portions of the Stillwater Complex provide wolverine habitat, this plan allocation would affect only about 2 percent of the maternal habitat and 3 percent of the primary wolverine habitat forestwide.

The Stillwater Complex is adjacent to the Absaroka-Beartooth Wilderness to the south, which provides abundant primary and maternal habitat for wolverines. Substantial development associated with the Stillwater Complex, including both existing infrastructure and potential future development, could affect wolverine movement through dispersal habitat. However, alternate movement corridors would be available to the northwest, south and southeast of the Stillwater Complex. Plan components for wolverines and lynx (FW-GDL-WLWV 01; NRLMD Guidelines HU G5, G12) would support mitigation measures to minimize snow compaction, such as location of facilities and timing of use, which could be imposed on any future proposals for minerals or energy development within the Stillwater Complex area.

Cumulative Effects

Cumulative effects under the Endangered Species Act include state, Tribal, local or private actions that are reasonably certain to occur within the action area for wolverine. Approximately 287879 acres of state, county, city, and privately owned lands fall within the boundaries of the Custer Gallatin National Forest in areas where wolverine may be present. This Non-federal ownership accounts for about 11% percent of all lands with potential habitat within the CGNF boundary. Given that wolverine habitat is typically associated with high elevation and colder alpine environments surrounding non-federal lands contain significantly lower levels of suitable habitat relative Forest lands. Human activities on non-federal lands are therefore much less likely to have potential impact on habitat suitability than federal actions. Lower elevation non-federal lands may provide connecting habitat for long distance dispersing individuals. Since the Forest Plan is a programmatic document that does not mandate, authorize or approve any site-specific projects or actions, it has no direct effects on wolverine, but could have indirect effects as future projects and activities are planned, approved and implemented in compliance with the revised plan. Therefore cumulative effects may result with ongoing and future actions allowed or implemented under land management plans for non-federal lands.

Montana Fish Wildlife and Parks developed a State Wildlife Action Plan (Montana FWP 2015), which identifies wolverine as an associated species with community types of greatest conservation need including coniferous forest, montane grassland, and riparian areas. In addition, wolverine is associated with several Focal Areas including the Beartooth face and Hebgen area. The State Wildlife Action Plan identifies wolverine as a species of greatest conservation need. The Wildlife Action Plan the state identifies potential threats to these systems such as habitat fragmentation, pollution, and development. The state plan as sets forth recommendation for how to manage and address potential threats to there.

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 2018). Since 2012 only one wolverine has been accidentally trapped on the Custer Gallatin. Given the habitat requirements and typical distribution of landscape use by the species it's unlikely that actions on private lands would have any substantial impact on seasonal use patterns. The most likely scenario regarding wolverine use of private lands is related to long distance dispersal events which are rare.

Community Wildfire Protection Plans (CWPP) are collaborative agreements between local governments, fire departments, and State forest management agencies in consultation with Federal land management agencies and other interested parties. CWPPs identify and prioritize areas needing hazardous fuel reduction on Federal and non-Federal lands to protect at-risk communities and essential infrastructure. CWPPs may assist State, local and private land owners by identifying areas in greatest need of fuel reduction treatment as well as recommending effective and efficient measures to reduce the chance that wild fire will ignite structures on their property (USDA 2004). Within the relevant geographic areas CWPPs could encourage non-federal land owners to conduct fuel treatment projects in potential wolverine habitat resulting in temporary or permanent alterations to habitat quality. This is unlikely to represent a severe threat to wolverine habitat given the general lack of suitable habitat on non-federal lands. All counties located in the geographic areas with potential wolverine habitat currently have CWPPs.

Determination of Effects

This biological assessment analyzes the potential impacts to wolverines through implementation of the programmatic Custer Gallatin National Forest revised land and resource management plan. Impacts to wolverines and their habitat have been considered in the context of factors that may influence survival and habitat use. The Forest has made the determination that implementation of the revised Forest Plan **may affect, but is not likely to adversely affect** the wolverine. Effects of the programmatic are insignificant and/or discountable due to plan components that guide potential forest actions with consideration given effects on individuals and habitat:

- Warming climates and impacts on persistent snow cover represents the primary threat to wolverines and their habitat. Forest management actions under the proposed plan are considered neither primary nor secondary threats to the wolverine. 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 2014a). These activities 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.
- The revised plan includes plan components designed to increase vegetation resilience to climatic stressors, which may help mitigate negative impacts from climate change.
- 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 typically occur on a small scale relative to the size of a wolverine's home range. Actions that would occur within wolverine habitats would primarily be designed to restore or maintain ecosystem health and diversity e.g. whitebark pine restoration. Likely resulting in a long term benefit to wolverines and their habitats.

- 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 includes a suite of plan components and land use allocations that would limit disturbance effects on wintering wolverines.
- The revised plan contains desired conditions for habitat connectivity, including specific plan components to limit management impacts in key linkage areas.
- Plan components 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.
- The revised plan 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.

Aquatic species

Western glacier stonefly

Species status and ecological information

Population status and distribution

Western Glacier Stonefly (WGS), *Zapada glacier*, was proposed for listing on October 4, 2016 by the U.S. Fish and Wildlife Service under the Endangered Species Act. Then on November 21, 2019 the U.S. Fish and Wildlife Service published a final rule listing *Zapada glacier* as Threatened under The Endangered Species Act. The most robust data set 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. 2017). In addition to Glacier National Park this species is now also documented in the Grand Teton National Park in Wyoming and in the Absaroka/Beartooth Wilderness, Custer Gallatin National Forest, of Montana.

Habitat requirements and life history

WGS is a stonefly in the order Plecoptera and family Nemouridae or spring stoneflies. This family of stoneflies has over 700 described species across the Holarctic region most of which inhabit smaller streams. Similar to many aquatic invertebrates WGS occupies stream habitats during their immature, or larval stage, before emerging as adults out of the water with newly formed wings in the spring. Then, they mate, deposit eggs in the streams, and perish completing their annual life cycle.

WGS occupies an extremely narrow habitat niche in only the uppermost reaches of alpine streams, near glaciers, springs, ice, or permanent snowfields. Giersch et al (2017) found their mean elevation to be at

2200m (7216 feet) and not more than 1407m from the source of that stream (glacier, snowfield, etc.). Giersch et al (2015) suggest that WGS has a much lower temperature preference than other *Zapada* species known to belong to group of cold water obligates. Their in-situ temperature data shows a maximum of 6.3°C for WGS while the cold water obligate temperature preference is at 8.8°C. WGS is among the shredder or collector gatherer functional feeding groups (Merritt and Cummins, 1996) meaning it's diet consists of small pieces of organic matter in the stream.

More presence/absence sampling is needed to understand the current distribution and more specific habitat preferences of this species. Currently, the presence of this species across the northern Rockies appears sparse. However, there also appears to be abundant habitat that has not been sampled, this species is difficult to sample at high elevations with small temporal window for researchers to access this area, and to confirm identification to the species level genetic analysis is required.

Environmental Baseline

Population status and distribution in the action area

WGS has been documented in six locations (table 32) of the Absaroka Beartooth Mountains geographic area (Giersch, personal communication). All of these locations are in the designated Absaroka Beartooth 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 and in potentially other remote montane locations across the CG.

Habitat conditions in the action area

While very limited data exists on WGS distribution in the plan area, it is probable that more available habitat occurs in these high elevation streams where very little FS management activities or human presence in general occurs. Further, based on known habitat requirements it is expected that if WGS is more widespread than currently known the locations would be located in wilderness and/or areas of such high elevation that no direct past CG management effects to habitat would be expected. In other words, the habitat that WGS inhabit are among the most pristine aquatic habitats on the Forest.

Little habitat data exists for the 6 known locations of WGS. However, in 2011 the Forest Service implemented the Watershed Condition Framework (USDA 2011) to identify the conditions of sub-watersheds. The watershed condition framework establishes a nationally consistent reconnaissance level approach for classifying watershed condition ranking them into one of three categories: Functioning properly, Functioning at risk, or impaired function. All of the sub-watersheds where WGS occur are ranked as functioning properly table 32).

Table 32. WGS known locations, sub-watersheds, and watershed condition.

Location	Sub-watershed HUC 6 Level (12 digit code)	Watershed Condition Framework Ranking
Silt Lakes Inlet	Upper West Fork Rock Creek (100700060904)	Functioning Properly
Timberline Lake Inlet	Upper West Fork Rock Creek (100700060904)	Functioning Properly
Castle Mountain Ice Field Outlet	Upper West Fork Rock Creek (100700060904)	Functioning Properly

Frosty Lake outlet	Wyoming Creek-Rock Creek (100700060901)	Functioning Properly
Jasper Lake Inlets (2)	Lake Creek (100700060105)	Functioning Properly

Factors affecting western glacier stoneflies

WGS inhabit a narrow habitat niche in some of the most extremely remote locations on the CG. These high elevation areas are covered under snow for up to 8 or 9 months of the year, depending on annual winter severity and snowpack. Due to this fact, WGS have very little direct anthropogenic impacts. Even potential recreational camping and recreational angling at high mountain lakes would have little impact as WGS inhabit the inlets and/or outlets of those lakes.

The biggest factors affecting WGS are the potential effects of climate change. Climate change is decreasing the size of glaciers and permanent snowfields (Hall and Fagre, 2003) and thus biological responses such as a change in macroinvertebrate communities are expected (Hotaling et al. 2017, Milner et al. 2009). In Glacier National Park Giersch et al. (2015) documented a decline in the range of WGS from 1960 to 2012 that was correlated with a decrease in glacier surface area. Their research demonstrates that this organism with an extremely limited habitat niche historically has decreased in extent even more as a direct result of the effects of global warming trends on alpine ecosystems.

Effects of the proposed action on factors affecting western glacier stoneflies in the action area

Healthy riparian areas, and in particular, streams with excellent water quality will provide the best habitat for WGS. WGS, on the CG, occur in streams far above tree-line devoid of woody plants and have a low volume of streamside forbs and grasses. The proposed action implements strong protections for watersheds and riparian areas (referred to as Riparian Management Zones or RMZ's) that provide greater resource protection than the previous Custer (1986) and Gallatin (1987) plans. Forest wide direction is to maintain or improve watersheds and RMZ's including protection of all native flora and fauna, in-stream physical-chemical process, and ecosystem process's of entire RMZ's and upslope soils that contribute to RMZ's (FW-DC-RMZ-01 to 02; FW-DC-WTR-01 to 07, 11-12; FW-DC-SOIL-01).

The following management activities will have no effect on WGS as they all occur far downslope and downstream of known WGS habitat all of which is in designated wilderness: Vegetation management, fuels management, roads and most infrastructure, mining, and livestock grazing. There is a hiking and recreational stock (ie: pack horses) trail network that extends into the Beartooth plateau. Currently trails do not intersect with known WGS locations and if WGS locations expand through potential inventory efforts and/or trails are expanded, moved, or reconstructed in the vicinity of WGS locations plan components would provide protection to ensure their habitat is maintained or enhanced (FW-STD-RT 03-05; FW-STD-WTR02, 04). Recreational impacts to streams and lakes in alpine areas are possible. However, known WGS on the CG locations are amongst large boulder/scree fields far out of the way from trails and recreation destinations such as lakes with a fishery. Further, in addition to the plan components already mentioned additional recreation plan components (FW-DC-REC-05; FW-STD-ROSP-01; FW-GDL-ROSP-01-02) ensure recreation will not have an impact on habitat for WGS.

Cumulative Effects

A potential cumulative effect is the practice of stocking fish into high mountain lakes, which is in the management purview of MFWP. If lakes were stocked with fish (various trout species have been

stocked in the area in the past) there is some potential those fish could move into outlet or inlet streams and prey on WGS. MFWP and the CG coordinate on these types of efforts and if fish stocking was proposed in the vicinity of WGS, this would occur at the project level of analysis. Further, FO-GA-DWA-04 points out this coordination in wilderness directly.

Determination

The proposed framework programmatic action will have *no effect* on the WGS.

Additional Plan Components specific to WGS include FW-GO-DWA-04, FW-STD-RT-03, FW-STD-RT-04, FW-STD-RT-05, FW-DC-REC-05, FW-STD-ROSP-01, FW-GDL-ROSP-01, FW-GDL-ROSP-02.

Plant Species

Whitebark Pine

The large, nutritious seeds produced by whitebark pine (*Pinus albicaulis*), are an important food for birds and mammals, and whitebark pine communities provide important habitat for many wildlife species. Whitebark pine seedlings survive on harsh, high elevation sites and, when fully grown, often act as nurse trees to less hardy conifers and undergrowth vegetation. At upper subalpine elevations, mature whitebark pine trees help to regulate snowmelt and reduce soil erosion. For these collective functions, whitebark pine is considered both a keystone species for promoting community diversity and a foundation species for promoting community stability (Keane et al. 2012, Keane et al. 2017). Severe population decline in whitebark pine communities is attributed to various causes, most significantly infection with white pine blister rust, recent outbreaks of mountain pine beetles (2000–2014), disturbances in wildland fire ecology (including fire suppression), forest succession, and climate change. In addition to its critical ecological role, the loss of whitebark pine also potentially impacts fire regimes, recreational experiences, and aesthetic perceptions (Tomback et al. 2001, Tomback and Achuff 2010, Keane et al. 2012, Keane et al. 2017). As a result, whitebark pine was determined by the USFWS to be a species warranted for federal listing but precluded under the Endangered Species Act on July 19, 2011 (76 FR 76 42631) (USFWS, 2011). Following a 12-month review, the USFWS determined on July 19, 2011, that whitebark pine is a candidate species, with listing as threatened or endangered warranted but precluded by higher priority actions (FR 76(138): 42631-42654). As a result, Region 1 added whitebark pine to the Regional Forester Sensitive Species list on December 24, 2011. USFWS reviewed whitebark pine's candidate status and rank December 2, 2016 and determined it to be appropriate as an 8 (FR 81(232), 87263). Any critical habitat designation will be determined during the development of the proposed listing rule.

Environmental Baseline

Habitat

Whitebark pine is a key ecosystem component growing at the highest forested elevations in cold, windy, snowy, and generally moist climatic zones (Arno and Hoff 1989) that are difficult areas for plants and animals to inhabit. Its tolerance to cold, superior hardiness on harsh microsites that exist after a fire, unique method of seed dispersal, and resistance to lower intensity fires, allows it to compete successfully in the upper subalpine zone where it often grows in a krummholz form (stunted, shrub-like growth) above tree line. On productive upper subalpine sites, whitebark is the major seral species that is eventually replaced by more shade tolerant species, mainly subalpine fir and occasionally Engelmann

spruce on the CGNF, while on harsh upper subalpine forests and at tree line it can successfully dominate as climax vegetation (Keane et al. 2012). Whitebark pine ecosystems were maintained through fire and insect regimes, and regenerate best in open, sunny conditions (Tomback et al. 2001). Whitebark pine has fairly low resistance to fire damage due to its thin bark. However, it is more resistant than its associates, subalpine fir and Engelmann spruce. High-intensity fires are likely to kill even the largest whitebark pine (Keane et al. 2000). However, in areas with low fuel levels and more widely scattered trees, some whitebark pine may survive the higher-intensity fires (Lorenz et al. 2008).

Whitebark pine has a unique method of seed dispersal and regeneration that involves a mutualistic relationship that has evolved between whitebark pine and the Clark’s nutcracker (*Nucifraga columbiana*) for seed dissemination. Whitebark pine is entirely dependent on this bird to disperse and sow its seeds for regeneration of the species. The bird extracts the seed from the cones and, if they do not immediately consume it, they cache the seed in small stores often in the ground and sometimes many miles from their source. Unretrieved seeds that are buried in the soil and on sites suitable for seed germination and establishment, such as open or fire-burned areas, are able to germinate, thus establishing new whitebark pine seedlings often further than wind distributed seeds of competing conifers.

Occurrence

Table 33 displays the occurrence of whitebark pine on NFS lands on the CGNF (both where it is dominant as a cover type and the total area where it is present), based on Forest Inventory and Analysis plots. This data represents the best statistically reliable estimates of whitebark pine occurrence based on plot data. Approximately 70% of the whitebark pine present on the CGNF occurs on the cold broad potential vegetation group, and to a lesser extent on cool moist and alpine sites.

Table 33. Whitebark pine occurrence on NFS lands on the CGNF ⁽¹⁾

Scale	Acres of WBP presence	Acres of WBP Dominance
Forestwide	433,793 (354,584 – 483,986)	213,798 (159,585 – 251,897)
Bridger, Bangtail, Crazy Mountains	32,073 (14,433 – 183,319)	16,037 (1,507 – 34,014)
Madison, Gallatin and Henry Mountains	144,946 (104,894 – 178,542)	58,293 (31,897 – 77,175)
Absaroka Beartooth Mountains	270,326 (208,023 – 317,741)	146,427 (105,012 – 180,460)

¹ Data from national base Forest Inventory Analysis (FIA plots), using the Hybrid 2011 and 2015 dataset. The ranges shown are the 90% confidence intervals around the estimates. Whitebark pine is not present on Geographic Areas not shown in Table (Pryors, Sioux and Ashland).

Dominance indicates areas where whitebark pine is dominant, as indicated by dominance types (Dom40 attribute).

Presence indicates areas where at least one whitebark pine tree is present.

The relationship between cover type and species presence shows that whitebark pine is dominant on far fewer acres than the total area where it is present. This indicates that in many areas whitebark is a minor component growing in areas dominated by other species. This relationship can be demonstrated by summarizing the cover type distribution within the areas where whitebark pine is present, as shown in table 34. These data indicate that where whitebark pine is present, it is often dominated by lodgepole pine or spruce/fir. Whitebark pine is dominant on just 35% of the areas where it occurs in the plan area.

Table 34. Distribution of cover types found on areas where whitebark pine is present¹

Cover Type	Percent of total whitebark presence
Douglas fir	4%
Lodgepole pine	14%
Spruce/fir	29%
Whitebark pine	35%
None (nonforested)	18%

¹ Data source: Hybrid 2011/2015 dataset of base Forest Inventory Analysis (FIA) plots

Although plot data (FIA) provides the best estimate of whitebark pine occurrence, maps of whitebark pine must also be used to facilitate a spatial analysis. It is difficult to map all areas where whitebark is present, because trees present in the understory or those that are a minor component in the overstory cannot be detected with remote sensing techniques and there is no comprehensive field inventory on the CGNF (such as stand exams). The R1 VMap is generally the best source of spatial data for vegetation using the R1 Vegetation Classification System (Barber et al. 2011, Brown 2016). This Landsat-derived spatial GIS layer depicts, among other things, dominance types across the CGNF. Because of the need for spatial data for analysis, VMap was used to analyze the effects of the revised plan alternatives and is the input layer used for vegetation modeling in SIMPPLLE (Chew et al. 2012). This layer maps a total of 275,368 acres of whitebark pine across the Forest on NFS Service lands, which closely resembles the FIA estimates. This is the best available spatial information to analyze whitebark pine on the CGNF (figure

18).

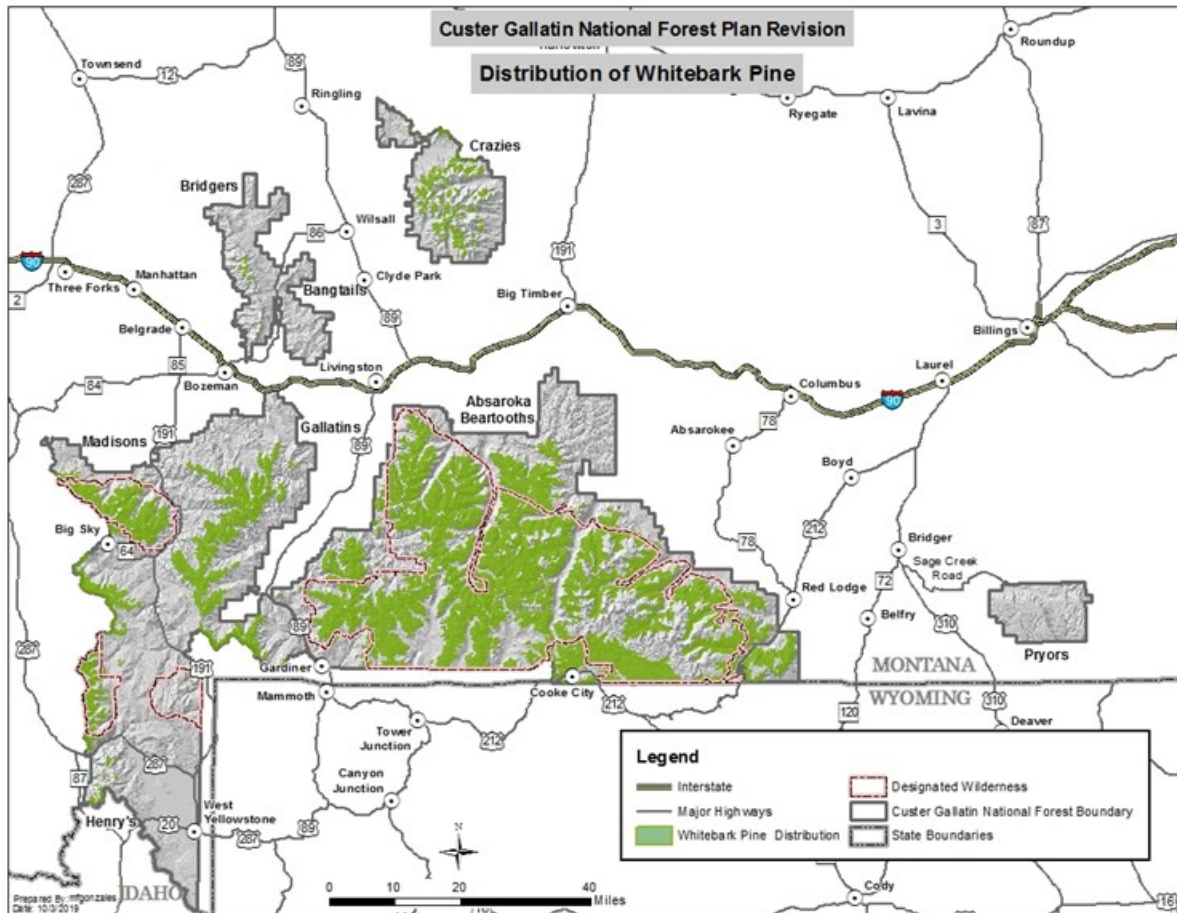


Figure 18. Distribution of whitebark pine dominated forest on the Custer Gallatin National Forest.

Trends and Threat Factors

A severe and steep downward trend has been occurring in the whitebark pine population and health over the past few decades, especially in the northern Rocky Mountains (Keane et al. 2012). Recent estimates from aerial surveys (2009) documented greater than 80% mortality of overstory whitebark pine throughout the Greater Yellowstone Ecosystem (GYE) (Macfarlane et al. 2013). This decline is expected to continue into the foreseeable future, although the rate may lessen simply because there are fewer live trees left to be impacted by disease or other threats. The declining trend occurs across the Region. Analysis at the Regional scale indicates that the abundance of live whitebark pine has decreased from 18.3% of periodic FIA plots containing at least one live whitebark pine tree, to 15.8% in the annualized inventory. In the GYE, plot-based surveys implemented by the National Park Service's Greater Yellowstone Inventory and Monitoring Program found similar estimates of mortality in the larger size class of trees that typically comprise the overstory population of whitebark pine. Mortality rates across the range of size classes were estimated to be 26% in the GYE (Shanahan et al. 2017). Across the range of size classes, primary mortality factors include exotic white pine blister rust (blister rust; *Cronartium ribicola*), native mountain pine beetle (*Dendroctonus ponderosae*), and wildland fire. Between 2004 and 2015, Greater Yellowstone Whitebark Pine Monitoring Working Group estimated

that 32% of dead whitebark pine showed evidence of MBP only (mainly in the 10-30cm size class), blister rust alone accounted for mortality of 14% of mortality, 8% was attributed to fire only while the remaining 46% showed a combination of these factors (Shanahan et al. 2017). Climate changes interacts with each of these stressors in complicated ways to generally amplify the threat to whitebark pine. Each of these threats and expected trends is addressed below.

White pine blister rust

White pine blister rust (WPBR) is an exotic fungal disease caused by the fungus *Cronartium ribicola* and infects all five-needle pines. It was introduced to eastern North America in the 1890s and into western North America in the first decade of the 20th century on infected eastern white pine nursery stock grown in France and shipped to Vancouver British Columbia. Since then, the pathogen has spread across the ranges of all five-needle pines in the United States and Canada, except for Great Basin bristlecone pine (Keane et al. 2017). As this disease has moved into fragile, high-elevation ecosystems, normal successional pathways have been altered. Because the disease is exotic, whitebark has limited defenses. Blister rust infection or cankers can cause the death of upper canopy cone-bearing branches, thus negatively impacting seed-production; cankers found on the lower portions of the bole will eventually kill an infected tree. Some landscapes in the northern Rocky Mountains contain so few undamaged trees and apparent rust resistant whitebark pine seed sources that there is major concern that whitebark pine seed dispersal is not occurring at any magnitude (McKinney and Tomback 2007).

Some natural selection for resistance to blister rust is likely occurring (Hoff et al. 2001), but the recovery of the species will be slow. Whitebark pine grows slowly and has a long generation time (trees need to be 60 to 80 years old before they produce sizable cone crops), and, as noted, there has been an especially dramatic decline in mature, cone-producing trees. The regeneration potential of the species is further exacerbated by evidence suggesting that stands with less than about 21 square feet per acre of live whitebark pine basal area provide too little cone production to reliably attract nutcracker seed dispersal (McKinney et al. 2009). A recent study suggests that in highly damaged whitebark pine stands, most seeds produced are consumed by nutcrackers and red squirrels rather than dispersed (McKinney et al. 2011). In 2015, monitoring data from the GYE indicated that approximately 25% of whitebark pine were infected with blister rust (Shanahan et al. 2017). Shanahan et al. (2016) concluded that in the GYE, smaller size class trees with white pine blister rust infection experienced higher mortality than larger trees suggesting that in the coming decades white pine blister rust may become the most probable cause of whitebark pine mortality.

Mountain Pine Beetle

The primary insect that kills whitebark pine trees is the mountain pine beetle (MPB). In the GYE, larger whitebark pine trees were preferentially attacked and killed by mountain pine beetle and resulted in a regionwide shift to smaller size class tree (Shanahan et al. 2016). Since 2000 mountain pine beetles have killed 75% of the mature cone-bearing trees in the Greater Yellowstone Ecosystem (Thoma et al. 2019). Mountain pine beetle mortality influences canopy condition, stand structure, species composition, forage production, wildlife habitat, fuel loading, water yields, and aesthetics. Following the death of the overstory, advanced regeneration from shade-tolerant tree species (subalpine fir, for example) is expected to release. Species composition plays a critical role at this time; if the stand has succeeded to shade-tolerant species, it would be expected that the stand composition would shift to that shade-tolerant species mixture (Keane et al. 2012).

MPB are native to high-elevation pine forests and presence of MBP in whitebark has been documented for at least 100 years (Arno and Hoff 1990). In high elevation forests, mountain pine beetle was historically limited by cold temperatures. Several large, widespread epidemics of mountain pine beetle caused high mortality of whitebark pine throughout the U.S. Rocky Mountains between 1909 and 1940 and again from the 1970s to the 1980s (Arno and Hoff 1990). However, with a warming climate winter temperatures have become mild enough to allow substantial overwinter survival of all life stages and there is sufficient summer thermal energy to complete an entire life cycle in one year (Logan et al. 2010, Bentz et al. 2016). Projections from climate models indicate future climate conditions will likely provide favorable conditions for beetle outbreaks within nearly all current whitebark pine habitat in the GYE by the middle of this century. Therefore, when surviving and regenerating trees reach ages suitable for beetle attack, there is strong potential for continued whitebark pine mortality due to mountain pine beetle (Buotte et al. 2016).

Wildland fire

For much of the 20th century, the practice of fire exclusion has kept fire from reaching higher elevations where whitebark pine occurs. Fire exclusion limits the regeneration and restoration of whitebark pine stands and has resulted in widespread successional replacement of whitebark pine with other trees, such as subalpine fir and Engelmann spruce. Whitebark pine has an advantage over its competitors in that it readily colonizes large, stand replacement burns because its seeds are transported great distances by Clark's nutcracker. Without fire, most seral whitebark pine forests would be replaced by subalpine fir or some other shade-tolerant high-elevation species (Keane et al. 2017). When a fire does occur, it tends to be more severe due to the increase in tree density, ladder fuels and downed woody material as well as the overwhelming presence of non-fire-resistant species. Although open, burned, and favorable habitat for whitebark pine regeneration is created by the fire, the lack of a sufficient number of cone-producing trees within caching distance severely limits the ability of this species to re-establish itself in areas where it historically was present or dominant.

Climate Change

Climate change is expected to interact with the trends and threats discussed above as well as have direct effects on habitat conditions. In general, the impact of projected climate change on whitebark pine is inconclusive and there is an element of uncertainty in the research about the potential effects to the species (Keane et al. 2017). Overall, however, whitebark pine is not expected to do well under future climates, primarily because of the current threats and severely declined population, its confinement to upper subalpine environments, and its lack of ability to regenerate because of nutcracker consumption of seed in areas of low whitebark pine populations (Keane et al. 2017). Direct habitat loss is anticipated to occur due to increased competition from species that normally cannot persist in whitebark pine habitats. Habitat loss will also occur if temperatures exceed the thermal tolerance for whitebark pine and the species is unable to survive the new conditions, though given its wide range and ecological tolerance, this is not likely to be as large a driver of reduced habitat availability. Rapid warming is expected to out-pace species migration to suitable habitats. Some studies suggest that the projected warmer conditions will severely reduce whitebark pine habitat and its distribution, perhaps restricting it to only the highest elevations (Warwell et al. 2007, Belote et al. 2015). Others, however, show that climate-mediated changes in disturbance regimes, such as increased fire frequencies, will reduce whitebark pine populations but not alter its current range (Loehman et al. 2011). Anecdotal evidence suggests that some whitebark pine forests are even experiencing abnormally high growth and more frequent cone crops with warmer summers and longer growing seasons (Keane et al. 2017). Recent

models indicate that climate change refugia trends will decrease the area of distribution of what is currently known in the interior distribution and limit its elevational range (Mahalovich et al. 2018). Notably, however, while an average of 85% of present day interior whitebark occurs in designated wilderness, less than 1% of the projected refugia are located within the boundaries of these unmanaged areas suggesting opportunities for active restoration. The effect of climate change on whitebark pine is complex because of the high uncertainty in regional climate change predictions, the high genetic diversity and resilience of the species, and the localized changes in disturbance regimes and interactions which may interact in uncertain ways. Table 35 summarizes what is known about potential effects of climate change on critical aspects of whitebark pine ecosystems.

Table 35. Summary of the effects of climate change on whitebark pine ecosystems at multiple scales (Tree, Community, Landscape) and multiple interactions (Disturbance, Nutcracker). Columns in the table include Factor (the ecosystem characteristic or process being impacted by climate change), the Climate Effect (the effect of climate change on that factor), Impact (the severity of that effect on the factor), Direction (the trend in whitebark pine population stability), Importance (the importance of the change in the factor to the decline of whitebark pine and the effectiveness of restoration on a scale of 1-low to 10-high), and Notes (any other material deemed important). (Keane et al. 2017)

Factor	Process affected	Climate effect	Impact	Direction	Importance	Notes
Tree						
Reproduction	Cone crop frequency and abundance	Increase	Moderate	Increase	4	Fine scale and coarse scale climate dynamics can influence cone crop dynamics
Regeneration	Germination	Decrease	Low	No change	2	
	Establishment	Uncertain	Moderate	Unknown	7	Difficult to evaluate if upper subalpine areas will be so hot and dry that seedlings will die
	Dispersal	Uncertain	Low	No change	5	Little is known of nutcracker-climate relationships
Growth	Tree diameter and height growth	Increase	High	Increase	5	It is unknown if understory whitebark pine seedlings and saplings will release
Mortality	Tree death	Uncertain	High	Increase	7	It is unknown if gains in vigor reduce mortality rates
Community						
Successional replacement	Competitor growth	Accelerate towards shade tolerant species	High	Decrease	8	Rate of successional replacement of whitebark pine to subalpine fir, spruce, and hemlock will increase
	Competitor growth and regeneration	Low soil moisture causes high competitor mortality	Low	Increase	3	Droughty sites
Disturbance						
Wildland fire	Increased fire frequency and intensity	May kill more whitebark pine, especially rust-resistant individuals	High	Decrease	7	Frequency might be so quick that fires burn regeneration before they reach reproductive maturity
	Larger and more severe fires	Increased burn areas create more caching sites free from competition	High	Increase	7	May kill those mature, cone-bearing trees that are somewhat rust-resistant thereby causing a loss of genetic diversity
MPB-caused Mortality	Increased frequency and severity of outbreaks	May kill more whitebark pine, especially rust-resistant individuals	High	Decrease	8	High mortality in cone-bearing trees resulting in a loss of rust-resistance and genetic diversity
WPBR-caused mortality	Increased spread	Increased spore production and spread	Moderate	Decrease	5	Highly variable climate may facilitate mutations in WPBR

Current Management

There is no plan direction specific to whitebark pine in the current separate forest plans for the Custer National Forest or Gallatin National Forest. As a candidate species, whitebark pine is protected as a Regional Forester's sensitive species in Region 1. It is managed within project areas to maintain or increase populations and restoration treatments are typically included in project areas that overlap with whitebark following the whitebark pine restoration strategy (Keane et al. 2012, Keane et al. 2017). Restoration efforts are typically project-related and occur as specialists' time, project timelines and budgets allow. Recently, the CGNF averages about 50 acres of whitebark planting a year and treats around 300 acres with verbenone each year. The CGNF is also an active participant in the Greater Yellowstone Coordinating Committee's (GYCC) subcommittee. The mission of the Whitebark Pine Subcommittee is to help ensure the long-term viability and function of whitebark pine in the GYA. In the face of an acute threat to a critical long-lived species, the GYCC Whitebark Pine Subcommittee is actively implementing the Whitebark Pine Strategy for the Greater Yellowstone Area (2011) with its associated Adaptive Action Plan – Whitebark Pine in the Greater Yellowstone Area (2015). Ongoing actions include extensive protection and restoration efforts, such as cone collection and planting across the GYA, and the establishment of a seed orchard and clone bank on the Custer-Gallatin NF. In addition, the CGNF is an active participant in the Regional tree improvement program for whitebark pine. This includes collecting cones and other materials from seed trees with some resistance traits to blister rust, as well as hosting a seed orchard and test plantation. Contributions to this breeding program is designed to yield rust-resistant seedlings to be used in restoration planting projects. Known areas of whitebark pine are also included in wildfire response decision making tools, and considered in fire management decisions.

Effects of the Proposed Action

The Proposed Plan provides a programmatic framework that guides site-specific actions but does not authorize, fund, or carry out any project or activity. Because the land management plan does not authorize or mandate any site-specific activities or ground-disturbing actions, there can be no direct effects.

The Proposed Action/Preferred Alternative for the Revised Custer Gallatin National Forest Land and Resource Management Plan will establish new management direction goals, desired conditions, objectives, guidelines, and standards for the recently combined Custer Gallatin National Forests. This action will place the newly combined forests under the management of a single land and resource management plan, where it was previously under two separate plans. This action establishes permissions and prohibitions on allowable activities including, timber harvest, commercial and personal use of forest products, prescribed and natural fire, livestock grazing, motorized uses and access, mineral activities, special uses and describes the vegetation desired conditions. These plan components will direct the management of whitebark pine directly and indirectly through changes to habitat and activities allowed on the landscape.

The loss of whitebark has dramatically altered the structure, composition and pattern of high-elevation ecosystems, and threatened their long-term stability and integrity. The precise future trend of whitebark pine on the CGNF is somewhat uncertain. Modeling indicates that whitebark may remain on the landscape at similar levels to what is present today, but likely below its natural condition and subject to stressors not well-represented by the modeling processes. Increases in expected fire may provide suitable seedbeds for the establishment of whitebark pine, but the health of stands and availability of

seed sources could limit those opportunities. Restoration activities are needed to address the threats to whitebark pine (USDI 2011). The percentage of whitebark that are resistant may increase slowly through the process of natural selection, if 5-needled pines are given a chance to regenerate (Tomback et al 2001). The Management Approaches section of the revised plan outlines several principles of restoration to help guide CGNF management of whitebark pine. These include:

- 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.
- Conserving genetic diversity, by collecting and archiving seeds and growing and planting genetically diverse seedlings.
- 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 MPB attacks, planting 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 effect of the new plan will be addressed by reviewing all pertinent plan components and the level of restoration opportunity for whitebark pine to ensure that the plan would contribute to the viability and maintenance of this species in the plan area. Due to the range-wide decline, and diseased condition within the plan area, the FS must be sure to preserve our ability to treat this species effectively and improve habitat conditions overall.

Direct and Indirect Effects

Forest plan components comply with the requirements of the Endangered Species Act of 1973. All federally recognized threatened, endangered, and candidate species would continue to be managed and protected across the Forest in accordance with Forest Service policy, recommended protection measures in recovery plans (if available), and all applicable state and federal laws. Project-level analysis would evaluate site-specific impacts to this species as a candidate, and consultation with the USFWS would take place for all projects potentially affecting threatened and endangered species. Additional design features or mitigation measures at the project level may be developed if it is determined that they are needed. As a result, there are no direct impacts for whitebark pine since this is a management plan and not dictating any action.

Key Stressors

As discussed above, the factors contributing to the declining trend of whitebark pine (wildland fire, blister rust, mountain pine beetles and climate change) are largely outside of CGNF control and are occurring range-wide. However, there are some opportunities for forest management to direct restoration and reduce threats and stressors. Fire management on the forest is one way to address

stressors to whitebark pine. An increase in the use of natural fire is expected to reduce the conversation of whitebark pine habitat to shade tolerant species and provide suitable seedbeds for regeneration. Frequent low severity fires, such as prescribed burning, that reduce ladder fuels, tree density, and downed woody material can reduce the risk of more catastrophic fire events that wipe out seed sources. The location of wildfire starts, however, is entirely outside of USFS control. The new forest plan cannot eliminate the effects of climate change as a stressor to whitebark pine, although there are some opportunities to use climate change data and refugia data to improve the effectiveness of future restoration treatments and adjust treatments overtime based on effectiveness and new climate response information. White pine blister rust and mountain pine beetle both occur range-wide and are outside of CGNF control to eradicate. However, there are restoration opportunities to contribute to the success of rust-resistant whitebark pine and to prioritize treatments such as implementing silvicultural cuttings to reduce competition, increase vigor and reduce likelihood of MPB attacks and planting rust-resistant seedlings to accelerate the effects of selection. Some of these are currently on-going and it is possible that additional resources will be available in the future.

Expected future trend of whitebark pine in the preferred alternative

The loss of whitebark pine has altered the structure, wildlife habitat values and long-term stability of high elevation ecosystems on the CGNF. The CGNF developed desired conditions for whitebark pine based on a natural range of variation (NRV) analysis that was conducted with the SIMPPLLE model (Chew et al. 2012). Based on this modeling, the whitebark pine cover type is currently estimated to be below its natural range of abundance, and at the low end of its range in terms of species presence (extent). 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) (Mahalovich et al. 2018).

SIMPPLLE modeling was utilized to predict the future trends of whitebark pine on the CGNF under the revised forest plan. This modeling predicts that with expected climate, disturbance, and vegetation management whitebark pine may remain relatively static over the next 5 decades, with the whitebark cover type generally remaining the same or slightly increasing and the overall presence of whitebark decreasing slightly, remaining either below or within the low end of the desired ranges. However, due to uncertainty and unpredictability in future disturbances and effects of climate change, it cannot be stated with certainty whether whitebark pine will move within the desired condition range during this time period; or, for that matter, if it will measurably increase from the existing condition.

The expected future trends as predicted by SIMPPLLE may initially appear encouraging, and is likely in part due to the increased extent of fire expected to occur on the landscape with a warming climate.

However, the model does not precisely account for the lower threshold of tree density necessary for successful seed dispersal (McKinney et al. 2009). Further, it does not reflect the vigor and health of those areas where whitebark remains present or dominant. Although these model results represent the best science available, there are still substantial concerns over the ability of whitebark pine to regenerate and persist in the future at levels similar to what has been present in the past.

Effects of Applicable Forest-wide and Geographic Area Plan Direction

The direction of the At-Risk Plant plan components, Fire and Fuels plan components and Terrestrial Vegetation plan components directly apply to the management of this species and the factors that are contributing to the species current population trends. Many of the other plan components will contribute to forest management that encourages conditions beneficial to whitebark pine more indirectly by maintaining habitat conditions and preventing ecosystem degradation.

At-Risk Plant Plan Direction

The At-Risk Plant plan components address whitebark pine as an at-risk species in addition to the vegetation plan components. These plan components support the long-term persistence of whitebark pine, include an Objective specifically for conducting a minimum of 1,000 acres of restoration treatments in whitebark pine per decade, and a Standard to ensure that whitebark pine would be considered and protected during project levels treatments. Based on this direction, the likelihood of accomplishing whitebark pine restoration treatments is higher under the Preferred Alternative than under the No Action alternative, which does not have any components that are specific to whitebark pine, though restoration treatments are often included in projects under the current forest plan. The following At-Risk Plant plan components represent a benefit to this species under the Preferred Alternative by emphasizing restoration treatments: FW-DC-PRISK-01, 02; FW-GO-PRISK-01, 02, 03; FW-OBJ-PRISK-01, 02; FW-STD-PRISK-01, FW-GDL-PRISK-01, 02.

These plan components direct the management of whitebark pine in the plan area to include restoration treatments. These components ensure that the management would include treatments to a greater extent than the current plan and actively apply best science to maintain and promote this species on the landscape by following the range wide strategy. This includes actions that are promoting rust resistance, conserving genetic diversity, saving seed sources, and employing restoration treatments. The action these components direct would have the ability to change over time based on the best available science and are expected to be beneficial to this species. The effectiveness of these plan components will be assessed though monitoring that is required by the plan.

Fire and Fuels Plan Direction

One of the factors contributing to the decline of whitebark pine is the absence of natural fire on the landscape due to fire suppression. The desired conditions of the revised plan encourage the use of natural fire as much as possible whenever it is safe to do so. Safe areas are often those areas outside of the wilderness urban interface and include more remote and high elevation areas of the forest. These areas often overlap with whitebark pine habitat and this direction would represent an increased opportunity for whitebark pine restoration in the plan area and a reduction in the threat factor of fire suppression. The plan components include: FW-DC-FIRE-01, 02, 03; FW-OBJ-FIRE-01, 02; FW-GDL-FIRE-01, 02, 03.

Carbon Plan Direction

Plan direction related to carbon is actually directly related to the conservation and management of whitebark pine. As a keystone species and sometimes the only tree component on fragile high elevation

sites, whitebark pine represents an important component of the carbon cycle where it grows. The plan direction for carbon further supports the importance of maintaining whitebark pine resilience and presence on the landscape. Desired Condition FW-DC-CARB-01 addresses carbon sequestration (i.e. promoting resilient forests adapted to natural disturbance) is fundamental to the long-term restoration and maintenance of whitebark pine. Perhaps more importantly, Goal FW-GO-CARB-01 encourages active partnerships with NGOs and researchers to understand the effects and appropriate management responses associated with the effect of climate change on ecosystem components – one of the most important threats to the long-term conservation of whitebark.

Terrestrial and Forested Vegetation Plan Direction

Terrestrial vegetation desired conditions are designed to maintain and enhance ecological integrity, diversity, function, and resiliency. The intent of terrestrial and Forested Vegetation plan components is to collectively provide for the full suite of native biodiversity across the plan area by addressing composition, structure, and function of vegetation communities using both a coarse filter and fine filter approach. The fine filter is addressed by components such as those specific to 1) threatened, endangered, proposed, and candidate species which are designated by the United States Fish and Wildlife Service; 2) species of conservation concern, which are identified by the Regional Forester; and 3) specific structural components of interest such as old growth, downed wood, and snags. Both the coarse and fine filter plan components contribute to the maintenance and restoration of whitebark pine on the CGNF landscape both by indicating the desired conditions based on natural range of variation for habitat types and whitebark pine specifically across geographical areas and by restricting management with standards and guidelines when necessary. Through these plan components, whitebark pine will be maintained and enhanced across the landscape. There is more species-specific emphasis in the preferred alternative than the current plan, which would apply to whitebark pine and have the potential to emphasize whitebark pine restoration treatments. All Forested Vegetation plan components contribute to sustainable terrestrial ecosystems. The following Forested Vegetation plan components would directly contribute to the maintenance and restoration of whitebark pine: FW-DC-VEGF-01, 02, 03, 04, 06; FW-OBJ-VEGF-01.

Soil Plan Direction

Soil plan components would maintain soil ecological functions, site productivity and sets limits on the amount of soil disturbance allowed and allowable levels of BMPs and soil stability. These plan components are intended to maintain soil quality and prevent damage to soil while supporting all vegetation types, including whitebark pine. Whitebark often grows on shallow, skeletal soils at upper treeline. Plan direction for soils is intended to help conserve soil productivity indirectly support whitebark pine establishment and growth, and conversely maintaining whitebark pine would help stabilize soils particularly on high elevation sites where little else can grow. The following plan components would maintain or enhance soil conditions for whitebark pine: FW-DC-SOIL-01, 02, 03; FW-STD-SOIL-01; FW-GDL-SOIL-07.

Wildlife and Lynx Plan Direction

Wildlife habitats depend largely on terrestrial vegetation. Therefore, the plan components for terrestrial vegetation represent most of the coarse-filter components that support the persistence of native species within the plan area. Overall the wildlife components besides the lynx direction are intended to maintain native vegetation and are expected to not impact or contribute to overall whitebark pine populations in the plan area.

The revised plan would incorporate the Northern Rockies Lynx Management Direction (USDA, 2007), which would influence vegetation management and how desired conditions are applied in potential lynx habitat. Approximately 22,267 acres of mapped whitebark pine occurs within potential lynx habitat (~9% of the total whitebark pine mapped). This overlap is common because whitebark is found on the potential habitat types and high elevation sites that also characterize lynx habitat (spruce/fir forests). Lynx direction and potential lynx habitat do not vary by alternative, so the Preferred Alternative has similar effects as the No Action Alternative. Occupied lynx habitat has been identified by the U.S. Fish & Wildlife Service.

There are two standards in the lynx direction that apply most to whitebark pine habitats. Standard VEG S5 and Standard VEG S6. Standard S5 applies to precommercial thinning areas and limits the amount of precommercial thinning that can overlap with snowshoe hare habitat. There are exceptions for S5 for restoration of whitebark pine specifically so minimal conflict is expected. Standard VEG S6 does not allow vegetation management that reduces winter snowshoe hare habitat in mature multi-story forests. This could affect whitebark pine by limiting the opportunity for some restoration activities because there are not any standard exceptions. This habitat condition most commonly develops on the cool moist and cold broad potential vegetation types and overlaps with areas of whitebark pine that are being impacted by competition from other conifer species.

Much of the whitebark pine found in lynx habitat is also in inventoried roadless, recommended wilderness, or designated wilderness areas where additional management restrictions apply; in these areas, prescribed fire and managing wildfires for resource benefits would be the primary tools available to promote whitebark pine. While VEG S6 would further limit opportunities, the result would be relatively incremental due to the other management restrictions applied to these land designations. Where whitebark is found in potential lynx habitat outside of inventoried roadless, recommended wilderness, or designated wilderness, VEG S6 would be the primary component that would reduce or delay the ability to perform restoration treatments for whitebark pine, such as removing spruce and fir components in mature, multistoried stands. The inability to apply vegetation management in whitebark pine forests where fire exclusion has allowed spruce/fir canopy layers to develop may result in foregoing some whitebark restoration opportunities. The amount of mapped whitebark pine that is found within potential lynx habitat, but outside of inventoried roadless, recommended wilderness, or designated wilderness is 13,599 acres, or 5% of the total whitebark pine area. This is the rough estimate of the area where VEG S6 would have a primary influence on limiting restoration activities in whitebark pine. The high amounts of disease present across much of the landscape suggests that high priority areas to treat will exist in the mapped habitat outside of restricted management areas.

Recreation Plan Direction

The Forest Plan delineates all lands on the CGNF into Recreation Opportunity Spectrum settings, which describe the desired recreational setting of each area. The settings include Primitive, Semi-primitive non-motorized, Semi-primitive motorized, Roaded natural, Rural, and Urban. There are associated plan components for each setting. Table 36 displays the distribution of mapped whitebark pine with ROS settings under the Preferred Alternative.

Table 36. Whitebark pine occurrence by ROS settings, Preferred Alternative

ROS Setting	% of total mapped whitebark pine
Primitive	71%
Semi-primitive non-motorized	20%

Semi-primitive motorized	7%
Roaded natural	2%
Rural	<1%

Because of its location at high elevation sites, whitebark pine most often occurs in primitive or semi-primitive non-motorized settings (which often overlap with other land designations such as inventoried roadless areas). These settings include prohibitions on motorized routes and emphasize the maintenance of natural vegetation and high scenic quality. These components would limit potential losses of whitebark pine that may occur with motorized uses (such as firewood cutting) and promote the protection and restoration of whitebark pine as a contributor to the natural vegetation and scenic quality of the area. Conversely, limited road access may increase the cost and reduce feasibility of some restoration treatments, particularly the opportunity to utilize mechanical equipment. For the whitebark found within Semi-primitive motorized and Roded Natural settings, the converse of these effects would apply. The distribution of whitebark pine across ROS settings in the Preferred Alternative is similar to that of the existing condition.

The Forest plan also includes direction for recreation opportunities. Due to its remote location, whitebark pine rarely coexists with developed recreation sites. However, dispersed camping may occur in areas with whitebark pine and many hiking trails allow for recreational access into whitebark pine areas. The following desired condition would help ensure that whitebark pine is not damaged due to activities associated with such sites. Further, these opportunities may help enhance the knowledge and appreciation for whitebark pine with the recreating public. Desired condition FW-DC-REC-05 speaks to the desire for recreation facilities (including trails and camp sites) to not have a negative impact on whitebark pine:

Designated Wilderness Plan Direction

Whitebark currently occurs in both designated wilderness areas on the CGNF: Absaroka-Beartooth Wilderness and the Lee Metcalf Wilderness. In these areas, essentially no management intervention would occur in whitebark pine areas, although naturally ignited fire may be allowed to burn. Wildfires are more likely to be allowed to burn within wilderness areas, and therefore the effects of fire exclusion (and succession to shade tolerant species) may be less prevalent in these areas.

The primary effect of the plan components for designated wilderness would be to limit restoration opportunities while increasing the use of natural wildfire. There are little to no restoration treatment opportunities for whitebark pine possible in wilderness areas, aside from managing wildfires for resource benefit.

Once whitebark stands reach a certain threshold, it is recommended to plant to restore the stand (Keane et al. 2012). By law, tree planting is not allowed in designated wilderness areas. However, planting outside of wilderness areas can provide genetically resistant seed source to the wilderness area given that nutcrackers can fly up to 22 km to cache seeds (Vander Wall and Hutchins 1983) therefore planting along the periphery can be beneficial – particularly following fire. The birds like to cache seeds in open areas (by fires), giving whitebark an early successional advantage over species whose seeds are distributed by wind and typically do not reach that far into a large disturbed area, reducing competition and allowing whitebark seedlings to stash. It is still possible to restore whitebark pine stands within wilderness by applying these restoration principles.

Although limiting to restoration activities, the plan direction for designated wilderness would afford this species and its habitat some additional protections. In addition, wildfire is more likely to be allowed to burn in these areas than in non-wilderness landscapes, due to their expanse and distance from values at risk. Since 2000, approximately 4,000 acres of areas currently mapped as whitebark pine have burned in Wilderness (60% of all fire in mapped whitebark pine). Wildfire can reduce shade tolerant competition and create suitable seedbeds for whitebark pine regeneration. Conversely, wildfire may also kill seed bearing individuals and further reduce regeneration potential. There is no difference between the preferred alternative and the existing condition with respect to this land designation.

Recommended Wilderness Plan Direction

The preferred alternative has approximately 16,619 acres of mapped whitebark pine in recommended wilderness areas, which constitutes 6% of all the mapped whitebark pine. These areas generally overlap inventoried roadless areas, but include more specific prohibitions on potential vegetation treatments. However, as compared to designated wilderness, plan components FW-DC-RWA-03 and FW-SUIT-RWA-01, 03 allow for more direct restoration management activities to occur in whitebark pine.

As with designated wilderness and inventoried roadless areas, natural fire may be more likely to be managed for resource benefit in these areas due to their remoteness and desired character. Natural fire regimes would be encouraged to contribute to a mosaic of different seral stages and diversity habitats as much as possible. This is generally beneficial to whitebark pine due to its reproductive advantage following fire. Since the bulk of each recommended wilderness area overlaps with current IRAs, the decrease in threats overall are minimal in these areas. All restoration activities would continue in recommended wilderness beneficial to whitebark pine. However, if Congress chooses to designate these areas as wilderness, the limitations as described above for designated wilderness areas would then apply.

As compared to the existing condition, the Preferred Alternative has more acres of whitebark pine within recommended wilderness. Approximately 1,766 acres of whitebark pine occur within recommended wilderness in the No Action Alternative, while 16,619 acres (6% of mapped whitebark pine) are within recommended wilderness with the Preferred Alternative. Therefore, roughly 14,853 more acres of whitebark would be subject to the direction for recommended wilderness under the preferred alternative as compared to the existing condition, or No Action alternative.

Inventoried Roadless Area Plan Direction

Approximately 45,771 acres of the mapped whitebark pine areas on the CGNF lie within inventoried roadless areas outside of RWA in the preferred alternative. One effect of the inventoried roadless area plan components, and the Roadless Area Conservation Rule, are to somewhat limit treatment opportunities for whitebark pine. Mechanical harvest (while not prohibited) would not occur to a great degree due to the limitations placed on vegetation treatments by the Rule and lack of road access.

However, the plan emphasizes restoration activities including prescribed fire and tree planting. Prescribed fire opportunities may be somewhat limited in these areas as compared to areas outside of inventoried roadless areas due to access for mechanical site preparation activities. Tree planting would be allowed in these areas, unless prohibited by other direction (for example, if the area became designated wilderness in the future by Congressional action). In addition, wildfires may be more likely to be managed for resource benefit in these areas as opposed to roaded landscapes, due to their remoteness. The relevant plan components are FW-SUIT-IRA-01 and 02.

Visitor Education and Interpretation Plan Direction

Along with the recreation plan components described above, desired condition FW-DC-RECED-01 is designed to promote public understanding and appreciation of natural resources, including whitebark pine.

Timber Plan Direction

Although whitebark pine is not a commercial timber species, plan direction that guides the management of timber would have impacts to whitebark pine. For example, on some accessible sites timber harvest could be utilized as a tool to remove competing species such as lodgepole pine or to create openings suitable for whitebark pine regeneration.

The Plan identifies lands suitable for timber production. On lands suitable for timber production, harvest is more likely to be used as a tool than in lands unsuitable for timber production, due to access and feasibility of treatments. Approximately 3,217 acres of the mapped whitebark pine on the CGNF occurs in lands suitable for timber production in the preferred alternative (<1% of suitable acres), similar to the no action alternative. This amount is minor because the common characteristic of sites where whitebark pine is found (high elevation, remote, steep topography, etc) are not conducive to timber suitability. Nevertheless, unless otherwise prohibited by other plan components or by access and feasibility, timber harvest could also occur in unsuitable lands as well to benefit whitebark pine. Specific timber plan direction relevant to whitebark pine includes FW-STD-TIM-02, 03, and 08.

Summary of Restoration Opportunities

The factors that are contributing to whitebark pine decline are largely outside of Forest Service control. The At-Risk Plant and Forested Vegetation plan components address whitebark pine specifically and this species would be maintained and enhanced on the landscape with an increased emphasis on restoration under the preferred alternative. The Fire and Fuels components would increase the amount of wildfire allowed within safe areas and permit wildfire to play as natural a role as possible, especially in wilderness and other more remote areas of the forest, which specifically would decrease the impacts of the role of fire suppression in the decline of whitebark pine. The rest of the plan components and direction discussed in this document more indirectly impact various aspects of the habitats and ecosystems conditions needed to maintain white pine on the landscape (e.g. soils, wildlife, carbon storage) and opportunities for restoration when natural processes are not enough.

Beneficial restoration treatments can occur under this alternative. The revised forest plan emphasizes restoration treatments for whitebark pine through the detailed vegetation desired conditions as well as the whitebark pine treatment objective. Therefore, overall, whitebark pine restoration efforts are expected to increase as a result of the preferred alternative.

Priority areas to treat for restoration purposes are those with high levels of disease and whitebark pine trees present demonstrating resistance. Anecdotally the disease is widespread across most if not all whitebark pine areas on the CGNF. In essence, any area with surviving whitebark pine likely contains some level of resistance. Areas at high risk to mountain pine beetle would also represent a priority. Due to the high levels of disease on the forest, much of the mapped whitebark pine in the plan area would benefit from restoration treatments.

Due to other plan components, restoration opportunities would be limited in certain areas, most specifically designated wilderness, recommended wilderness, and potential lynx habitat. Restoration

opportunities would be somewhat restricted, but to a lesser degree, in inventoried roadless areas. The distribution of mapped whitebark pine and these designations is listed in table 37. Of these, only recommended wilderness varies as compared to the existing condition (or no action alternative). The various designations may overlap one another so the total acres affected is not cumulative.

Table 37. Whitebark pine occurrence in areas that limit restoration opportunities

Designation	Percent of total whitebark pine acres
Designated wilderness	72%
Recommended wilderness	6%
Potential lynx habitat	9%
Inventoried roadless areas	17%

Approximately 6,391 acres mapped with whitebark pine (2% of the total) have burned recently (from 2000-2018) in wildfire; while it is likely some seed-bearing trees were lost, these fires may also have reduced shade tolerant competition and/or provided suitable sites for regeneration. About 60% of those areas (3,858 acres, 4% of the total mapped whitebark pine acres) burned within designated wilderness areas, further supporting the conclusion that wildfires may accomplish some restoration of the whitebark pine in those areas that are most restricted from active restoration activities.

The total amount of acres with whitebark pine present that are *not* within the land designations in the Preferred Alternative as shown in table 37 (designated wilderness, recommended wilderness, potential lynx habitat, and/or inventoried roadless area) is 13,599, about 5% of the total mapped whitebark pine. However, inventoried roadless areas are not overly restrictive to whitebark pine restoration, because prescribed fire, hand treatments, and planting are all allowable even if slightly less feasible due to access. The most restrictive land designations with respect to restoration activities are wilderness, recommended wilderness, and potential lynx habitat. The amount of area with whitebark present that does not occur in those more restrictive designations under the Preferred Alternative is 55,080, or roughly 22% of the total. This is the area where whitebark restoration opportunities are most feasible and likely to occur; it is most likely that the objective of 1,000 acres of treatment per decade would occur within these areas. The combination of active restoration activities in these areas (such as to meet objective FW-PRISK-OBJ-02) and natural processes (including wildfire for resource benefit) in the remaining 78% of whitebark pine areas, has the potential to positively affect the condition of whitebark pine on the CGNF over the life of the forest plan. In addition, the CGNF is an active participant in the Regional whitebark pine breeding program, which includes not only seed and material collections from disease-resistant “plus trees”, but also hosting several tree improvement out-planting sites, including a test plantation and a seed orchard, which over time would provide locally-adapted and rust-resistant seed for restoration plantings.

Cumulative Effects

The majority of whitebark pine populations and suitable habitat occur on forest service lands but other management plans may have a cumulative effect on whitebark pine management across its range (table 38). Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Table 38. Summary of cumulative effects to at-risk plant species from other resource management plans

Resource plan	Description and Summary of effects
Montana Statewide Forest Resource Strategy (2010)	MT conducted a Statewide assessment of forest resources 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 whitebark pine. This management is expected to be complementary, though some impacts to populations could occur.
County wildfire protection plans	Some county wildfire protection plans map and/or define the wildland urban interface. The CGNF 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. Generally, whitebark pine occurs outside of the Wildland Urban Interface. Overall, the effect of the county plans would be to influence where treatments occur to contribute to desired vegetation conditions, including whitebark pine habitats.
County Growth plans	The counties will work with Forest service to enhance communities. The county plans generally aim to maintain native vegetation communities and reduce noxious weeds. The reservation of native habitats will maintain habitat for whitebark pine where it occurs. Generally, whitebark pine occurs outside of areas that would be significantly affected by county growth plans.

Determination of Effects and Rationale

Candidate

The proposed action **may affect, but is not likely to adversely affect** whitebark pine in the plan area. There is the potential of some negative impacts on the ability to actively restore whitebark pine from the plan direction described above. However, the revised plan components also promote active restoration activities in areas that are accessible as well as promote an increase in natural fire, thereby reducing negative effects of fire suppression. In addition, several of the plan components will provide additional protections or benefits to whitebark pine. Overall, the benefits expected as a result of the revised plan would make any negative impacts insignificant and/or discountable to whitebark pine if it becomes listed.

As discussed in the above sections, the revised plan includes recommended wilderness areas, suitability for timber production and timber harvest, lynx direction, and updated plan direction. By in large, the plan direction presented in the Preferred Alternative represents a benefit to whitebark pine, by specifically addressing it under desired vegetation conditions and other vegetation and at-risk plant plan components, including an objective for whitebark restoration treatments. Lynx plan direction, as well as designated wilderness and inventoried roadless area direction, limits restoration opportunities to a degree in many whitebark pine areas; however, this direction applies to the existing condition and No-Action alternative as well. The inclusion of recommended wilderness areas in the Preferred Alternative represents a relatively minor degree of increased limitations on restoration treatment opportunities as compared to the No Action Alternative. In summary:

- Soil plan components would be beneficial to whitebark pine by ensuring that management maintains soil productivity.
- Fire and Fuels plan components emphasize on natural role of fire, whether possible and an increase in natural fire reduces the stressor of fire suppression
- Terrestrial and Forested Vegetation plan components would help promote whitebark pine by enumerating desired conditions for this species.
- At-risk Plants plan components would help promote whitebark pine by ensuring habitat conditions are present, protecting whitebark pine from potential harm from management activity, stating restoration treatment acre objectives and monitoring the degree to which whitebark pine objectives are achieved.
- Lynx direction would limit some whitebark pine restoration treatment opportunities within potential lynx habitat, to the same degree with the preferred alternative as the no action alternative.
- Designated Wilderness restrict some important restoration opportunities; the preferred alternative is not designating any new wilderness and is identical to the no action alternative in this regard. It creates the potential for future increase in wilderness based on recommended wilderness areas proposed.
- Recommended wilderness and Inventoried Roadless Areas may limit restoration opportunities somewhat due to a lack of access or opportunities to mechanically prepare treatment sites; however natural fire may be more likely to be managed for resource benefit in these areas due to their remoteness and desired character.
- Public Information, Interpretation, and Education plan components encourage appreciation and therefore maintenance of natural systems.
- Timber management is not expected to be a factor in whitebark pine listing (USFWS 2011) so there is no impact expected from timber for whitebark pine. Whitebark would be considered prior to any vegetation treatment and FS plan components would be followed. The plan allows that when consistent with resource objectives, harvest could be used as a tool for whitebark pine restoration in some areas.
- Carbon Storage and Sequestration plan components support the importance of maintaining whitebark pine resilience and presence on the landscape and encourage partnering with external partners to understand (and appropriately manage for) the effects of climate change.

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