United States Department of Agriculture

# Draft Environmental Impact Statement

## Proposed Revised Land Management Plans for the Malheur, Umatilla, and Wallowa-Whitman National Forests

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Forest Service

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# Draft Environmental Impact Statement
# Proposed Revised Land Management Plans
# for the
# Umatilla, Malheur, and Wallowa-Whitman National Forests

**Baker, Crook, Grant, Harney, Malheur, Morrow, Umatilla, Union, Wallowa, and Wheeler Counties, Oregon**
**Asotin, Columbia, Garfield, and Walla Walla Counties, Washington**

**Lead Agency:** USDA Forest Service

**Cooperating Agencies:**

Confederated Tribes of the Umatilla Indian Reservation
State of Oregon
Baker County, Oregon
Grant County, Oregon
Harney County, Oregon
Morrow County, Oregon
Umatilla County, Oregon
Union County, Oregon
Wallowa County, Oregon
Wheeler County, Oregon
Asotin County, Washington
Columbia County, Washington
Garfield County, Washington

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**Abstract:** This draft environmental impact statement (DEIS) documents the analysis of six alternatives (alternatives A through F) developed by the Forest Service for the programmatic management of approximately 4.9 million acres administered by the Malheur (including the portion of the Ochoco National Forest administered by the Malheur National Forest), Umatilla, and Wallowa-Whitman National Forests. For ease of reference, the accompanying proposed revised land management plan reflects the preferred alternative. The alternatives are described in appendix A. Alternative A is a no-action alternative, and would keep in place the management direction from the 1990 land and resource management plans, as amended. Alternative B is a modified version of the proposed action, and alternative E is the preferred alternative.

Alternatives B, C, D, E and F address five purpose and needs for the revised plans: (1) to more adequately protect and restore terrestrial plant and animal species and their habitats; (2) to address management of fuels and fire risk; (3) to more adequately protect and restore watersheds and aquatic habitats; (4) to address climate change; and (5) to recognize the interdependency of social and economic components with national forest management.

Alternatives B through F address new information and concerns that emerged during the implementation of the 1990 forest plans and comply with Federal laws, regulations, and policies. These alternatives also address significant issues (unresolved conflicts with the proposed action) that were identified from comments received during the scoping and public involvement period.

The Forest Service will use the “predecisional administrative review process,” also referred to as the “objection process” described in 36 CFR 219 Subpart B of the 2012 Planning Rule. This process gives an individual or entity an opportunity for an independent Forest Service review and resolution of issues before the approval of a plan revision, this subpart identifies shows may file objections to a plan revision; the responsibilities of the participants in an objection; and the procedures that apply to the review of the objection. §219.53 describes who may file an objection. Individuals and entities who have submitted substantive formal comments related to this plan revision during the opportunities for public comment for this decision may file an objection.

It is important that reviewers provide their comments at such times and in such a way that they are useful to the agency’s preparation of the final EIS and Revised Plans. Therefore, comments should be provided prior to the close of the comment period and should clearly articulate the reviewer’s concerns and contentions. The submission of timely and specific comments can affect a reviewer’s ability to participate in subsequent administrative or judicial review. Comments received in response to this solicitation, including names and addresses of those who comment, will be part of the public record for this proposed action. Comments submitted anonymously will be accepted and considered; however, anonymous comments will not provide the respondent with standing to participate in subsequent administrative or judicial reviews. Comments on the DEIS should be specific and should address the adequacy of the statement and the merits of the alternatives discussed (40 CFR 1503.3).

**Send Comments to:** http://www.fs.usda.gov/goto/BlueMountainForestPlanRevisionComments

OR

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**Date Comments Must Be Received:** Within 90 days following publication of the notice of availability of the DEIS in the Federal Register. The notice is expected to be published on or around March 14, 2014; however, it is the commenter’s responsibility to calculate the end of the 90-day period.

# Summary

## Introduction and Background

The three Blue Mountains national forests began efforts to revise their forest plans in 2003. Since then, national planning rules that govern revising forest plans have been in flux. The final plans for the Malheur (and the portion of the Ochoco, administered by the Malheur), Umatilla, and Wallowa-Whitman National Forests have been prepared using transition language in the recently approved planning regulations (36 CFR 219, 2012), which has provisions that allow forest plan revisions started under the 1982 planning regulations to finish using the 1982 process.

The Analysis of the Management Situation (reflected in the 2004 Current Management Situation (CMS)) for the Hells Canyon National Recreation Area showed that there was no need for change in this area of the Wallowa-Whitman National Forest; therefore, this area was not analyzed in this EIS. The 2003 Hells Canyon Comprehensive Management Plan will be the guiding document for this portion of the Wallowa-Whitman, which is tiered to the 1990 Wallowa-Whitman National Forest Plan.

## Purpose and Need

The existing forest plans are 20 years old. Economic, social, and ecological conditions changed during that time; new laws, regulations and policies are in place; and new information based on monitoring and scientific research is available. The Malheur, Umatilla, and Wallowa-Whitman National Forests are revising their 1990 forest plans to meet the legal requirements of the National Forest Management Act (NFMA) of 1976; to address changed conditions and provide consistent management direction (as appropriate) across the three national forests; to incorporate changes in law, regulation, and policy; and to use new scientific information. In particular, the interdisciplinary planning team intends to address the following areas in the revised forest plans:

1. To more adequately protect and restore terrestrial plant and animal species and their habitats.
2. To address management of fuels and fire risk.
3. To more adequately protect and restore watersheds and aquatic habitats.
4. To address climate change.
5. To recognize the interdependency of social and economic components with national forest management.

## Proposed Action

The proposed action is a revision of the land management plans for the Malheur (including the portion of the Ochoco National Forest adjacent to and administered by the Malheur National Forest), Umatilla and Wallowa-Whitman National Forests designed to meet the purpose and need. It includes revised goals (desired conditions), objectives, standards, guidelines, suitable uses and activities, management area designations including special areas, and monitoring items.

# Issues and Alternatives

The Blue Mountains forest plan revision team distributed the proposed action for public review in 2010, and the following issues were developed to respond to public concerns expressed during the review.

## Issue 1: Access

**Concern Statement:** Some people suggested allocating additional areas to undeveloped backcountry to satisfy needs, such as solitude and nonmotorized recreation, while others requested that additional areas be designated to allow motor vehicle recreation and requested that what is currently available not be reduced.

## Issue 2: Economic and Social Well-being

**Concern Statement:** Many people stressed the importance of economic and social contributions of the national forests to the surrounding communities. One concern is the importance of maintaining the infrastructure in local communities (e.g., mills, roads, equipment, and skilled labor force), so that the Forest Service can draw upon that infrastructure to accomplish restoration goals as well as contribute to the economic and social well-being of communities. Another concern is the potential effects of large disturbances, such as insects and disease or wildland fire, on the economic and social well-being of local communities. Other people stressed ecological values and suggested that a more cautious approach and mix of restoration activities is necessary to protect those values that also contribute to economic and social well-being.

## Issue 3: Livestock Grazing and Grazing Land Vegetation

**Concern Statement:** Several people expressed concern about how revised forest plan direction will affect livestock operations and livelihoods and the potential that further restrictions on allotments would have significant financial and social effects. Other comments were directed to the effects of permitted livestock grazing on National Forest System lands and resources and revolved around riparian area livestock use and its effect on fisheries, biodiversity, and water quality. The potential for disease transmission between domestic sheep and bighorn sheep is also a concern.

## Issue 4: Old Forest

**Concern Statement:** Many people suggested an active approach to reducing the risk of loss from insects and disease and wildland fire within old forest stands and accelerating the development of old forest structure. Other people prefer the use of nonmechanical means to restore old forest stands and the designation of old forest management areas.

## Issue 5: Recommended Additions to the National Wilderness Preservation System

**Concern Statement:** Many people asked that additional areas be proposed for wilderness designation to protect the values that they attach to wilderness areas. Others requested that no additional areas be proposed for wilderness designation because this would prevent them from participating in the activities that they currently enjoy within those areas. Wilderness designation would also limit management activities that could provide economic benefits while reducing the risks of uncharacteristic wildland fire, insect, and disease disturbances.

### Issue 6: Ecological resilience

**Concern Statement:** There is concern about the type and extent of management activities for restoring ecological resilience that are included in the proposed action. Based on perceptions of current vegetation conditions and resilience, some respondents stated that the proposal is too aggressive, while others stated that the restoration proposal is not aggressive enough. Public concern is heightened because the management approach to restoring ecological resilience will determine the ecosystem services the Blue Mountains national forests provide.

## Alternatives

Six alternatives, including continuing under current management direction (no action) and modifications to the proposed action (the "action" alternatives) were developed to address the range of public comments received during the scoping process. The following summarizes the key concepts used in developing the action alternatives. Table S-1 also provides a comparison of how the issues are addressed by alternative. The desired conditions are the same for each of the action alternatives, with the exception of roads and trails, which has a range of desired conditions.

**Alternative B (modified proposed action).** This alternative focuses on restoring landscape functions and processes, and ecosystem resilience to climate change.

- **Access**. Road density would change from a standard and guideline to a desired condition. The most backcountry limited motor vehicle use management areas (618,800 acres) and some backcountry nonmotorized (78,600 acres) would be designated. No wildlife corridor would be designated.
- **Ecological resilience**. There would be moderate management actions to restore ecological resilience, and no change to treatments to restore forested vegetation. The combination of vegetation treatments, roads treatments, and grazing practices would result in improvements in watershed condition in 4 to 23 subwatersheds.
- **Economic and social well-being**. The predicted annual timber harvest would be 87 million board feet, resulting in an estimated 600 jobs associated with timber harvest and primary wood products manufacturing. The estimated number of jobs from timber, range, ecosystem restoration and forest employees would be 3,737.
- **Livestock grazing/grazing land vegetation**. There would be slightly lower objective levels than today's numbers and locations for both cattle and sheep, primarily to reduce the risk of disease spread from domestic sheep to big horn sheep.
- **Old forest**. There would be no designated old forest management areas. Old forest would be managed where it occurs on the landscape. Restrictions on large tree harvest (trees greater than 21-inch diameter) would be included but exceptions would be allowed for safety, wildland-urban interface, maintaining open ponderosa pine stands, as well as reducing competition in hardwood stands and special habitats. There would be progress towards developing old forest habitat by thinning.
- **Recommended wilderness area**. A limited amount of acreage (13,400 acres) would be identified as recommended wilderness area.

**Table S-1. Comparison of how each alternative addresses the issues**

| Issue | Alternative B | Alternative C | Alternative D | Alternative E | Alternative F |
|---|---|---|---|---|---|
| Access | • Road density changed from a standard and guideline to a desired condition.<br>• Designates the most backcountry limited motor vehicle use management areas (618,800 acres) and some backcountry nonmotorized (78,600 acres).<br>• No wildlife corridor designated. | • Road density changed from a standard and guideline to a desired condition.<br>• Management areas feature backcountry nonmotorized (586,300 acres) and wildlife connectivity (502,000 acres).<br>• No backcountry motorized.<br>• One mile per square mile open route density in wildlife corridor. | • Road density changed from a standard and guideline to a desired condition.<br>• Retains the areas that currently are generally suitable for motor vehicle use, resulting in more area suitable for summer and winter motor vehicle use compared to the other alternatives. | • Road density changed from a standard and guideline to a desired condition.<br>• Management areas feature backcountry nonmotorized (228,100 acres), backcountry motorized (425,200 acres), and connective wildlife corridors (28,100 acres). | • Road density changed from a standard and guideline to a desired condition.<br>• Management areas feature backcountry nonmotorized (228,100 acres), backcountry motorized (425,200 acres), and connective wildlife corridors (28,100 acres). |
| Ecological resilience | • Moderate level of management actions to restore ecological resilience.<br>• No change to treatments to restore forested vegetation.<br>• The combination of vegetation treatments, roads treatments, and grazing practices results in improvements in watershed condition in 4-23 sub-watersheds. | • Highest level of resource-specific objectives for managing some wildland fires to meet desired landscape conditions and watershed restoration.<br>• Emphasizes improving hydrologic function and connectivity within anadromous and bull trout Key Watersheds. | • Highest level of resource-specific objectives for forest vegetation restoration.<br>• Management allocations emphasize areas where active forest management may occur. | • Higher level of objectives for watershed restoration and emphasis on improving hydrologic function and connectivity within anadromous and bull trout Key Watersheds.<br>• Includes specific objectives for managing wildland fires to meet desired landscape conditions and aggressive objectives for treating invasive plants. | • Higher level of objectives for watershed restoration and emphasis on improving hydrologic function and connectivity within anadromous and bull trout Key Watersheds.<br>• Includes specific objectives for managing wildland fires to meet desired landscape conditions and aggressive objectives for treating invasive plants. |

| Issue | Alternative B | Alternative C | Alternative D | Alternative E | Alternative F |
|---|---|---|---|---|---|
| Economic and social well-being | • Predicted annual timber harvest: 87 MMBF, 650 jobs.<br>• Expected number of jobs from timber, range, ecosystem restoration: 3,737. | • Predicted annual timber harvest: 47 MMBF, 288 jobs.<br>• Expected number of jobs from timber, range, ecosystem restoration:2,822. | • Predicted annual timber harvest: 243 MMBF, 2,040 jobs.<br>• Expected number of jobs from timber, range, ecosystem restoration: 5,413. | • Predicted annual timber harvest: 162 MMBF, 1,330 jobs.<br>• Expected number of jobs from timber, range, ecosystem restoration: 4,496 | • Predicted annual timber harvest: 107 MMBF, 838jobs.<br>• Expected number of jobs from timber, range, ecosystem restoration: 3,909 |
| Livestock grazing/ grazing land vegetation | • Slightly lower objective levels than existing numbers and locations for cattle and sheep.<br>• Reduces the risk of disease spread from domestic sheep to big horn sheep. | • Significantly reduces the number of cattle and sheep AUMs.<br>• Classifies riparian areas and subwatersheds with habitat for listed fish species as generally unsuitable for cattle grazing. | • Objective levels similar to existing numbers and locations for cattle and sheep.<br>• Reduces the risk of disease spread from domestic sheep to big horn sheep, but allows grazing to occur in previously vacant allotments. | • Livestock levels the same as the proposed action.<br>• Standards and guidelines for sage grouse protection are included. | • Livestock levels the same as the proposed action.<br>• Standards and guidelines for sage grouse protection are included. |

| Issue | Alternative B | Alternative C | Alternative D | Alternative E | Alternative F |
|---|---|---|---|---|---|
| Old forest | • No designated old forest management areas.<br>• Old forest managed where it occurs on the landscape.<br>• Desired conditions provide old forest management direction.<br>• Restrictions on large tree harvest (trees greater than 21-inch d.b.h.) are included but exceptions allowed for safety, wildland-urban interface, maintaining open ponderosa pine stands, as well as reducing competition in hardwood stands and special habitats. | • Designates old forest management areas (390,900 acres).<br>• Only trees 8 inches d.b.h. or less authorized for timber harvest in this management area.<br>• Management activities outside old forest stands retain live old forest trees (greater than 21-inch d.b.h.).<br>• Desired conditions provide old forest management direction.<br>• Vegetation treatments emphasize wildland fire (wildfires or prescribed fires) rather than mechanical treatments rather than. | • No designated old forest management areas.<br>• Old forest managed where it occurs on the landscape.<br>• No standard or guideline prohibiting the harvest of trees greater than 21-inch d.b.h. or trees with old forest characteristics.<br>• Desired conditions provide old forest management direction.<br>• Vegetation treatments emphasize mechanical treatments rather than wildland fire (wildfires or prescribed fires). | • No designated old forest management area.<br>• Retains trees with old forest characteristics across the landscape.<br>• No standard or guideline prohibiting the harvest of trees greater than21 inch d.b.h.<br>• Desired conditions provide old forest management direction.<br>• Vegetation treatments would emphasize both mechanical treatments and prescribed fire. | • No designated old forest management area.<br>• Retains trees >150 years old.<br>• No standard or guideline prohibiting the harvest of trees greater than21 inch d.b.h.<br>• Desired conditions provide old forest management direction.<br>• Vegetation treatments would emphasize both mechanical treatments and prescribed fire. |
| Wilderness | • Recommended wilderness:13,400 acres | • Recommended wilderness: 505,000 acres | • No wilderness recommended. | • Recommended wilderness: 91,000 acres | • Recommended wilderness: 91,000 acres |

**Alternative C.** This alternative addresses the issues of increased recommended wilderness areas, passively improved ecological resilience and limited access by emphasizing the role of natural processes in forest restoration.

- **Access.** Management allocations would emphasize backcountry nonmotorized areas (586,300 acres) and wildlife connectivity (502,000 acres) with limited harvest. There would not be any backcountry motorized areas. There would be one-mile per square mile of open route density in wildlife corridors.
- **Ecological resilience.** The highest levels of resource-specific objectives would be established for managing some wildland fires to meet desired landscape conditions and watershed restoration; emphasizing improving hydrologic function and connectivity within anadromous and bull trout key watersheds.
- **Economic and social well-being.** Annual timber harvest would be reduced to 54 million board feet, resulting in about 270 jobs associated with timber harvest and primary wood products manufacturing. The estimated number of jobs from timber, range, ecosystem restoration and forest employees would be 2,822.
- **Livestock grazing and grazing land vegetation.** The number of cattle and sheep AUMs is significantly reduced, by classifying riparian areas and subwatersheds with habitat for listed fish species as generally unsuitable for cattle grazing.
- **Old forest.** Old forest management areas (390,900 acres) would be designated. Only trees 8 inches d.b.h. or less would be authorized for timber harvest in this management area. Management activities outside old forest stands would retain live old forest trees (21 inches d.b.h. or larger).
- **Recommended Wilderness Area.** The highest level of recommended wilderness areas (505,000 acres) would be provided. Recommended wilderness area additions would not only expand existing wilderness areas, but also establish new wilderness areas.

**Alternative D.** This alternative addresses the issues of increased access, actively improved ecological resilience, and increased economic and social well-being.

- **Access.** The areas that currently are generally suitable for motor vehicle use would be emphasized, resulting in more area suitable for summer and winter motor vehicle use than proposed by other alternatives.
- **Ecological resilience.** Management allocations would emphasize areas where active forest management may occur.
- **Economic and social well-being.** The predicted annual timber harvest for the three national forests would be 243 million board feet, resulting in about 1,870 jobs associated with timber harvest and primary wood products manufacturing. The expected number of jobs from timber, range, ecosystem restoration and forest employees would be 4,496 jobs.
- **Livestock grazing and grazing land vegetation.** There would be similar objective levels to today's numbers and locations for both cattle and sheep, reducing the risk of disease spread from domestic sheep to big horn sheep, but grazing would be allowed to occur in previously vacant allotments.
- **Old forest.** No old forest management areas would be designated. There would not be any standard or guideline prohibiting the harvest of trees larger than 21 inches d.b.h. or trees with old forest characteristics. Desired conditions would be used to provide old forest management direction. Vegetation treatments would emphasize mechanical treatments rather than wildland fire use (wildfires or prescribed fires).

- **Recommended wilderness area.** No designated recommended wilderness area.

**Alternative E (Preferred Alternative).** This alternative addresses the issues of increased access, actively improved ecological resilience, and increased economic and social well-being.

- **Access.** Management areas would feature backcountry nonmotorized areas (228,100 acres), backcountry motorized vehicle areas (425,200 acres) and connective wildlife corridors (28,100 acres).
- **Ecological resilience.** A higher level of objectives would be provided for watershed restoration with an emphasis on improving hydrologic function and connectivity within anadromous and bull trout key watersheds. There would also be specific objectives for managing some wildland fires to meet desired landscape conditions and aggressive objectives for treating invasive plants.
- **Economic and social well-being.** Annual timber harvest would be about 162 million board feet, resulting in about 1,220 jobs associated with timber harvest and primary wood products manufacturing. There would be an estimated 266,600 cattle and sheep AUMs, supporting about 170 jobs. Forest Service ecosystem restoration expenditures would be about $25 million, supporting about 470 jobs. Forest Service budget expenditures would be about $61.4 million, supporting about 1,150 jobs. The total number of jobs expected would be 4,496 jobs.
- **Livestock grazing and grazing land vegetation.** Livestock levels would be the same as the proposed action; standards and guidelines for sage grouse protection would be included.
- **Old forest.** Trees with old forest characteristics would be retained across the landscape. There would not be any standard or guideline prohibiting the harvest of trees 21 inches d.b.h. or larger. Desired conditions would provide old forest management direction. There would not be any designated old forest management areas. Vegetation treatments would emphasize both mechanical and wildland fire treatments rather than wildland fire use.
- **Recommended wilderness area.** Recommended wilderness areas (91,000 acres) would be designated in strategic locations (expanding wilderness areas or in areas in cooperation with other landownership wilderness designations (such as BLM land)).

**Alternative F.** This alternative is very similar to alternative E, having essentially the same emphasis and management allocations. The primary distinction is the level of restoration activity would be closer to the level predicted in the proposed action, alternative B. The differences would be primarily in the contribution to economic and social well-being and old forest guidelines.

## Comparing Alternatives

The alternatives are appropriately compared by how each affects long-term trends of key environmental indicators and considerations. Measurement indicators have been determined, and chapter 3 includes detailed documentation of the anticipated environmental effects for each alternative.

The Blue Mountains national forests have identified three primary goals. These goals create the framework for the plan. Each goal identifies a set of desired conditions, standards, guidelines, and objectives. The desired conditions describe in general terms what we (the public and the Forest Service) desire the forests to look like and the goods and services we want them to provide. Desired conditions are broad and may only be achievable over long periods of time. Objectives are concise, time-specific statements of measurable, planned results that make progress toward or maintain desired conditions. Variation in achieving objectives may occur during the life of the plan because of factors such as changes in environment conditions or available budgets. The Forest Service will manage the land and resources of the planning area to achieve or maintain the goals and desired conditions, allowing the national forests to contribute to a range of outcomes now and in the future. The goals, and desired conditions, standards, guides, and objectives specific to each alternative, are discussed in detail in appendix A to the DEIS.

### Goal 1: Promote Ecological Integrity

Ecological integrity is a condition that sustains the wholeness or completeness of ecosystem structure, composition, and function. The national forests' contribution to ecological function is described by watershed function, species diversity, productive capacity, disturbance processes, and invasive species. Ecological structure and composition is described by structural stages; plant species composition; and stand density. Landscape patterns, special habitats, and snags and down wood are also indicators of sustainability in the Blue Mountains national forests. Although the primary focus of this section is ecological integrity, this goal and the desired conditions are interrelated with the social and economic components of sustainability.

### Goal 2: Promote Social Well-being

Social well-being contributes to national forest resilience by promoting public use patterns and restoration strategies that support human communities, livelihoods, cultures, and social values. National forests contribute to community resilience by providing jobs, ecosystem services, scenery, and recreational opportunities. Each individual's ties to the land, traditional cultures, and communities help characterize social well-being, and attachments to places reflect core values. These ties can be reflected in the values different people place on biodiversity, scenery, economic opportunities, self-reliance, tradition, and ecological integrity.

A diverse and complex set of values that contribute to one's social well-being can be tied to natural resources-related work, including restoration, ranching, and recreation. This work allows people to live in communities that are adjacent to the national forests. These values may include viewing or hunting wildlife, being able to do natural resource-related work, knowing that restoration efforts are supporting fish populations, and being part of an environment where human traditions and cultures can be maintained.

### Goal 3: Promote Economic Well-being

Economic well-being is a condition that enables people to work, provide income for their families, and support the economies of local communities, American Indian tribes, the region, and the Nation. The contributions of the national forests to economic well-being are described for capital and wealth and for the economic production of goods and services. However, there are many other values, benefits, and costs not addressed in discussions of economic well-being because they are not traded in the marketplace. These values are difficult to express in monetary terms or other quantitative measures, but are an important part of social and economic sustainability.

Historically, the national forests of the Blue Mountains made significant contributions to area communities, both socially and economically. However, the national forests are not the sole providers of economic stability for communities in the area. Local economic conditions are interrelated with changes in the economies of Oregon, Idaho, and Washington, as well as with changes in regional, national, and global economies. Recognizing the interdependence between the Forest Service's need for forest management work and the degree to which local industries, infrastructure, and people provide for this need is important to sustaining and restoring the ecological integrity of the national forests and social and economic conditions of the communities.

## Preferred Alternative

Alternative E has been identified as the preferred alternative for revising the forest plans for the Blue Mountains national forests.

## Comparison of Key Indicators

Based on proposed objectives, tables S-2 through S-4 on the following pages display the projected accomplishments for the key indicators for each action alternative. The figures displayed for alternative A represent the existing condition. See appendix A for a detailed description, including objectives, of the alternatives.

**Table S-2. Issues and key indicators for each alternative for the Malheur National Forest**

| Key Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| **Issue 1: Access (Malheur NF)** | | | | | | |
| Miles of road maintained annually | 1,152 | 1,136 | 235 | 1,604 | 1,313 | 1,313 |
| Percent change in area available for route designation for summer motor vehicle use | 0% | 7% | minus-38% | 11% | 8% | 8% |
| Percent change in area available for winter over-the-snow vehicle use | 0% | negligible | minus-28% | 2% | minus-1% | minus-1% |
| **Issue 2: Economic and social well-being (Malheur NF)** | | | | | | |
| Timber harvest jobs | 133 | 142 | 67 | 418 | 263 | 170 |
| Timber harvest income | $7,214M | $7,674M | $3,625M | $22,660M | $14,224M | $9,238M |
| Livestock grazing jobs | 389 | 398 | 187 | 439 | 395 | 389 |
| Livestock grazing income | $5,195M | $5,316M | $2,550M | $5,881M | $5,276M | $5,195M |
| Recreation jobs | 233 | 233 | 233 | 233 | 233 | 233 |
| Recreation income | $4,589M | $4,589M | $4,589M | $4,589M | $4,589M | $4,589M |
| Ecosystem restoration jobs | 68 | 68 | 41 | 125 | 85 | 62 |
| Ecosystem restoration income | $2,066M | $2,066M | $1,252M | $3,790M | $2,575M | $1,867M |
| Predicted harvest levels/TSPQ (MMBF/year) | 30 | 31 | 16 | 87 | 56 | 37 |
| Allowable sale quantity (MMBF/year) | 55 | 55 | 34 | 88 | 55 | 55 |
| **Issue 3: Livestock grazing and grazing land vegetation (Malheur NF)** | | | | | | |
| Acres suitable for permitted cattle grazing | 1,197,000 | 1,225,000 | 620,000 | 1,216,000 | 1,197,000 | 1,197,000 |
| Acres suitable for permitted sheep grazing | 102,000 | 101,000 | 55,000 | 101,000 | 101,000 | 101,000 |
| Permitted animal unit months (cattle) | 117,000 | 120,000 | 61,000 | 119,000 | 117,000 | 117,000 |
| Permitted animal unit months (sheep) | 6,500 | 6,500 | 1,200 | 6,500 | 6,500 | 6,500 |
| Rate of progress towards achieving rangeland vegetation desired condition | slow to moderate | slow to moderate | fastest | slow | moderate to fastest | moderate to fastest |

| Key Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| **Issue 4: Old Forest (Malheur NF)** | | | | | | |
| Acres of old forest within management area allocations with limited management activity | 78,000 | 81,000 | 350,000 | 73,000 | 85,000 | 85,000 |
| Acres of vegetation treatments per year in old forest | 500 | 800 | 0 | 4,800 | 1,600 | 1,000 |
| Percent old forest at year 50 (all potential vegetation groups) | 33 | 31 | 31 | 30 | 30 | 30 |
| Percent dry upland forest old forest single story at year 50 | 13 | 11 | 10 | 16 | 16 | 12 |
| **Issue 5: Preliminary Administratively Recommended Additions to the National Wilderness Preservation System (Malheur NF)** | | | | | | |
| Acres of MA 1B | 0 | 1,200 | 83,800 | 0 | 30,400 | 30,400 |
| **Issue 6: Ecological Resilience (Malheur NF)** | | | | | | |
| Annual forested vegetation active restoration activities (acres) | 18,100 | 18,700 | 14,300 | 25,100 | 24,800 | 20,100 |
| Miles of road treatments | 260 | 260 | 600 | 650 | 290 | 310 |
| Forage use intensity | 15.9% | 15.9% | 3.8% | 17.0% | 15.9% | 15.9% |
| Miles of riparian area improvement | 300 | 300 | 600 | 300 | 450 | 400 |
| Number of subwatersheds in improved condition | 16 | 16 | 42 | 18 | 21 | 21 |
| Improvement in the dry upland forest potential vegetation groups FRCC departure score at year 50 (percent) | 24 | 27 | 23 | 47 | 42 | 31 |

**Table S-3. Issues and key indicators for each alternative for the Umatilla National Forest**

| Key Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| **Issue 1: Access (Umatilla NF)** | | | | | | |
| Miles of road maintained annually | 427 | 427 | 209 | 910 | 540 | 540 |
| Percent change in area available for route designation for summer motor vehicle use | 0% | 7% | minus-45% | 9% | minus-5% | minus-5% |
| Percent change in area available for winter over-the-snow vehicle use | 0% | negligible | minus-30% | 2% | minus-4% | minus-4% |
| **Issue 2: Economic and social well-being (Umatilla NF)** | | | | | | |
| Timber harvest jobs | 243 | 263 | 117 | 777 | 561 | 339 |
| Timber harvest income | $13,882M | $15,006M | $6,707M | $44,365M | $32,058M | $19,388M |
| Livestock grazing jobs | 153 | 130 | 19 | 127 | 127 | 127 |
| Livestock grazing income | $1,874M | $1,674M | $219M | $1,631M | $1,631M | $1,631M |
| Recreation jobs | 187 | 187 | 187 | 187 | 187 | 187 |
| Recreation income | $4,527M | $4,527M | $4,527M | $4,527M | $4,527M | $4,527M |
| Ecosystem restoration jobs | 75 | 75 | 56 | 143 | 102 | 75 |
| Ecosystem restoration income | $2,907M | $2,907M | $2,163M | $5,511M | $3,946M | $2,889M |
| Predicted harvest levels/TSPQ (MMBF/year) | 27 | 29 | 16 | 76 | 56 | 36 |
| Allowable sale quantity (ASQ) ) (MMBF/year) | 51 | 51 | 31 | 73 | 51 | 51 |
| **Issue 3: Livestock grazing and grazing land vegetation (Umatilla NF)** | | | | | | |
| Acres suitable for permitted cattle grazing | 284,000 | 298,000 | 30,000 | 284,000 | 284,000 | 284,000 |
| Acres suitable for permitted sheep grazing | 60,000 | 28,000 | 13,000 | 42,000 | 42,000 | 42,000 |
| Permitted animal unit months (cattle) | 30,000 | 31,000 | 3,000 | 30,000 | 30,000 | 30,000 |
| Permitted animal unit months (sheep) | 7,800 | 4,600 | 1,200 | 5,800 | 5,800 | 5,800 |
| Rate of progress towards achieving rangeland vegetation desired condition | slow to moderate | slow to moderate | fastest | slow | moderate to fastest | moderate to fastest |
| **Issue 4: Old Forest (Umatilla NF)** | | | | | | |
| Acres of old forest within management area allocations with limited management activity | 142,000 | 188,000 | 322,000 | 176,000 | 191,000 | 191,000 |
| Acres of vegetation treatments per year in old forest | 300 | 500 | 0 | 2,900 | 1,000 | 500 |

| Key Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| Percent old forest at year 50 (all potential vegetation groups) | 29 | 28 | 28 | 26 | 27 | 27 |
| Percent dry upland forest old forest single story at year 50 | 15 | 12 | 11 | 14 | 15 | 13 |
| **Issue 5: Preliminary Administratively Recommended Additions to the National Wilderness Preservation System (Umatilla NF)** | | | | | | |
| Acres of MA 1B | 0 | 1,400 | 248,500 | 0 | 40,100 | 40,100 |
| **Issue 6: Ecological Resilience (Umatilla NF)** | | | | | | |
| Annual forested vegetation active restoration activities (acres) | 16,950 | 17,400 | 14,000 | 20,100 | 23,400 | 18,700 |
| Miles of road treatments | 260 | 260 | 450 | 800 | 300 | 270 |
| Forage use intensity | 11.4% | 10.6% | 0.8% | 13.8% | 10.6% | 10.6% |
| Miles of riparian area improvement | 150 | 150 | 300 | 150 | 225 | 210 |
| Number of subwatersheds in improved condition | 23 | 23 | 25 | 25 | 23 | 23 |
| Improvement in the dry upland forest potential vegetation groups FRCC departure score at year 50 (percent) | 20 | 23 | 17 | 35 | 35 | 28 |

**Table S-4. Issues and key indicators for each alternative for the Wallowa-Whitman National Forest**

| Key Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| **Issue 1: Access (Wallowa-Whitman NF)** | | | | | | |
| Miles of road maintained annually | 444 | 444 | 204 | 700 | 359 | 359 |
| Percent change in area available for route designation for summer motor vehicle use | 0% | minus-1% | minus-53% | minus-1% | minus-10% | minus-10% |
| Percent change in area available for winter over-the-snow vehicle use | 0% | negligible | minus-38% | minus-2% | minus-8% | minus-8% |
| **Issue 2: Economic and social well-being (Wallowa-Whitman NF)** | | | | | | |
| Timber harvest jobs | 201 | 245 | 104 | 845 | 506 | 329 |
| Timber harvest income | $11,112M | $13,526M | $5,723M | $46,722M | $28,000M | $17,716M |
| Livestock grazing jobs | 258 | 242 | 102 | 267 | 258 | 258 |
| Livestock grazing income | $3,435M | $3,241M | $1,304M | $3,556M | $3,435M | $3,435M |
| Recreation jobs | 397 | 397 | 397 | 397 | 397 | 397 |
| Recreation income | $7,678M | $7,678M | $7,678M | $7,678M | $7,678M | $7,678M |
| Ecosystem restoration jobs | 81 | 81 | 45 | 156 | 98 | 69 |
| Ecosystem restoration income | $2,582M | $2,582M | $1,449M | $5,001M | $3,143M | $2,215M |
| Predicted harvest levels/TSPQ (MMBF/year) | 24 | 27 | 15 | 80 | 50 | 34 |
| Allowable sale quantity (ASQ) ) (MMBF/year) | 46 | 46 | 22 | 75 | 46 | 46 |
| **Issue 3: Livestock grazing and grazing land vegetation (Wallowa-Whitman NF)** | | | | | | |
| Acres suitable for permitted cattle grazing | 408,000 | 393,000 | 135,000 | 422,000 | 408,000 | 408,000 |
| Acres suitable for permitted sheep grazing | 25,000 | 22,000 | 22,000 | 25,000 | 25,000 | 25,000 |
| Permitted animal unit months (cattle) | 77,000 | 74,000 | 26,000 | 80,000 | 77,000 | 77,000 |
| Permitted animal unit months (sheep) | 4,500 | 3,500 | 3,500 | 4,500 | 3,500 | 3,500 |
| Rate of progress towards achieving rangeland vegetation desired condition | slow to moderate | slow to moderate | fastest | slow | moderate to fastest | moderate to fastest |

| Key Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| **Issue 4: Old Forest (Wallowa-Whitman NF)** | | | | | | |
| Acres of old forest within management area allocations with limited management activity | 144,000 | 152,000 | 290,000 | 143,000 | 153,000 | 153,000 |
| Acres of vegetation treatments per year in old forest | 200 | 300 | 0 | 2,900 | 700 | 500 |
| Percent old forest at year 50 (all potential vegetation groups | 22 | 21 | 21 | 20 | 21 | 21 |
| Percent dry upland forest old forest single story at year 50 | 9 | 8 | 7 | 11 | 11 | 9 |
| **Issue 5: Preliminary Administratively Recommended Additions to the National Wilderness Preservation System (Wallowa-Whitman NF)** | | | | | | |
| Acres of MA 1B | 0 | 10,800 | 172,700 | 0 | 20,300 | 20,300 |
| **Issue 6: Ecological Resilience (Wallowa-Whitman NF)** | | | | | | |
| Annual forested vegetation active restoration activities (acres) | 17,650 | 18,150 | 14,450 | 22,650 | 23,450 | 19,850 |
| Miles of road treatments | 260 | 260 | 400 | 800 | 300 | 270 |
| Forage use intensity | 12% | 12% | 3% | 17% | 12% | 12% |
| Miles of riparian area improvement | 250 | 250 | 500 | 250 | 375 | 350 |
| Number of subwatersheds in improved condition | 4 | 4 | 14 | 2 | 5 | 4 |
| Improvement in the dry upland forest potential vegetation groups FRCC departure score at year 50 (percent) | 5 | 7 | 4 | 16 | 16 | 11 |

# Contents of Volume 1

## Contents of Volume 2:



## Contents of Volume 3:

# Chapter 1. Purpose of and Need for Action

## Introduction

The U.S. Department of Agriculture (USDA), Forest Service, has prepared this draft environmental impact statement (DEIS) in compliance with the National Environmental Policy Act (NEPA) and other relevant Federal and State laws and regulations. This DEIS discloses the environmental consequences that could result from the proposed action and alternatives. The document is organized into four chapters.

### Document Structure

**Chapter 1. Purpose of and Need for Action**: This chapter includes information on the history of the proposal, the purpose of and need for the action, and the Agency's proposal for achieving that purpose and need. This chapter also describes the public involvement process.

**Chapter 2. Alternatives, including the Proposed Action**: This chapter describes the alternatives developed to address the purpose and need for change. It also describes alternatives not considered in detail. A summary comparison of alternatives is provided at the end of the chapter.

**Chapter 3. Affected Environment and Environmental Consequences**: This chapter describes current conditions on the Malheur (including the portion of the Ochoco administered by the Malheur), Wallowa-Whitman and Umatilla National Forests and the environmental consequences of implementing each alternative at a programmatic level.

**Chapter 4. List of Preparers, Consultation and Coordination**: This chapter provides a list of preparers and agencies consulted during the development of the DEIS.

**Glossary and Acronyms**: The glossary provides definitions of terms used in this document and shows acronyms related to those terms.

**References:** The references section provides a list of all the literature and other source materials cited within the text.

**Appendices**: The appendices provide additional detailed information in support of the analyses presented in the DEIS. Appendix A provides a description of the alternatives including the no-action alternative. Appendix B provides methodology and assumptions. Appendix C provides a list of the cumulative effects. Appendix D provides detailed descriptions of the Laws and Regulations. Appendix E documents the wild and scenic river eligibility evaluation for the Blue Mountains forests plan revision. Appendix F describes the process used to evaluate the wilderness potential of 76 areas within the Blue Mountains forests plan revision area. Appendix G displays the total acres suitable for cattle or sheep grazing in each allotment.

**Map packet**: The map packet is a separate packet that includes management area maps for each action alternative.

## Background

Efforts to revise forest plans for the Malheur, Umatilla, and Wallowa-Whitman National Forests began in 2003. Since then, national planning rules that govern revising forest plans have been in flux. The original planning rule was established in 1982. This revision process for the revised forest plans has fallen under the 2000, 2004, 2008 and 2012 planning rules. This revision process was conducted under the legal framework of the National Forest Management Act, and the provisions of the 1982 Planning Rule, as allowed by the 2012 Planning Rule language (36 CFR 219.7(b)(3)).

The primary needs or goals of forest management expressed in a forest plan are established by the National Forest Management Act, Multiple Use Sustained Yield Act, and Organic Act. Goals from these acts that are applicable to this revision effort include:

- Provide for biodiversity through habitat restoration or maintenance to assure species viability
- Provide clean and cold water, to the extent feasible, for domestic uses and habitat needs
- Sustain ecological processes from which ecosystem health is derived
- Provide sustainable vegetation, thus habitat conditions
- Assure resistance and resilient response to threats, such as climate change, uncharacteristic fires, and broad scale insects and disease infestations and epidemics
- Contribute to social and economic well-being through sustainable levels of goods and services

While the 1990 forest plans addressed these goals and needs, there is a need to update the management strategies used to meet them. Revisions to the 1990 forest plans come from many sources, including forest plan monitoring; new scientific information, particularly from the Interior Columbia Basin Ecosystem Management Project (ICBEMP); new national policy, direction, and initiatives; and watershed assessments.

The NFMA states that the land management plan is to be revised from time to time when the secretary finds conditions in a unit have significantly changed, but at least every 15 years (NFMA) (16 U.S.C. 1604 (f) (5) (A)). Revision of the 1990 forest plans is needed because the plans are beyond the 10 to 15 year revision timeframe and because conditions and demands have changed.

The Forest Service has amended the 1990 forest plans many times to respond to changes in conditions and demands and to update management direction. The Malheur National Forest now includes greater than 60 plan amendments, the Umatilla National Forest greater than 30, and the Wallowa-Whitman National Forest greater than 40. Region wide amendments account for five of each total, while the remaining amendments address nonsignificant plan amendments or forest specific management direction. Plan amendments address changes related to four general categories:

1. **Establishing management plans for special areas,** including management plans and boundary establishment for wild and scenic rivers and establishment of research natural areas
2. **Adopting management strategies for selected resources:** use of natural fire for resource benefits, management of competing and unwanted vegetation, stewardship of the Eagle Cap Wilderness Area, and management of bighorn sheep
3. **Addressing changing perspectives on management of controversial resources**, such as old forest and anadromous and inland threatened or endangered fish species
4. **Authorizing project-specific changes**, which comprise the vast majority of the amendments

These regionwide amendments referenced in item 3 include the Eastside Screens, PACFISH, and INFISH. Initially intended as interim direction to stay in place as work on ICBEMP was completed, these amendments evolved into long-term direction when the decision was made to limit the ICBEMP effort to scientific reference rather than management direction. This interim direction placed constraints on management activities by limiting removal of trees 21 inches d.b.h. or larger and allowing limited situations where harvest in late and old structure stands may occur. PACFISH and INFISH defined stream buffers referred to as riparian habitat conservation areas (RHCAs) and limited the management activities that could occur within them.

As referenced in item four, project specific amendments were plentiful. Some applied to standards and guidelines and management area boundaries to account for unexpected conditions, such as those created by wildland fire. Others made adjustments in response to unexpected projects, such as land exchanges. As it became evident that the Eastside Screens, PACFISH, and INFISH would become long-term direction, some projects included specific amendments to this interim direction. Those amendments permitted activities that include limited removal of trees 21 inches d.b.h. or larger, selected harvest in late and old structure stands, and vegetation manipulation in RHCAs associated with specific project areas.

A common need for change that can be derived from these amendments is that the 1990 forest plans were relatively inflexible and tended to respond poorly to the dynamic nature of natural resource systems. Therefore, this revision effort provides an opportunity to address a need for more flexible and adaptive management plans.

Since the Eastside Screens, PACFISH, and INFISH were originally prescribed as interim direction, the resulting changes to outputs of goods and services from these amendments were not determined through the amendment process. As the interim direction evolved into long-term direction, the impact on outputs was and is greater than anticipated. NFMA instructs the Forest Service to provide the public with information about expected outputs (within the capability of the land), and this revision effort provides an opportunity to address that obligation.

Although the 1990 forest plans were completed at the same time, they were developed independently of each other and by three interdisciplinary teams. As a result, there are similarities between the plans, but distinct differences resulted from the work of separate teams. This forest plan revision effort provides an opportunity to coordinate these plans and strategically define what management direction should be consistent across the three national forests and what direction should be distinct for each national forest.

While the forest plan revision effort is based on the need for change, an opportunity exists to incorporate emerging climate change information, reclassify standards and guidelines as desired conditions where appropriate, update processes and models, and reduce duplication of Forest Service Handbook and Manual direction and existing laws, regulations, and policies.

## Purpose and Need

The existing forest plans are 20 years old. Economic, social, and ecological conditions changed during that time; new laws, regulations and policies are in place; and new information based on monitoring and scientific research is available. The Malheur, Umatilla, and Wallowa-Whitman National Forests are revising their 1990 forest plans to meet the legal requirements of the National Forest Management Act (NFMA) of 1976; to address changed conditions and provide consistent management direction (as appropriate) across the three national forests; to incorporate changes in law, regulation, and policy; and to utilize new scientific information. In particular, the interdisciplinary planning team intends to address the following areas in the revised forest plans:

1. **To more adequately protect and restore terrestrial plant and animal species and their habitats.** Two objectives in the Strategic Plan for the Forest Service are to "provide ecological conditions to sustain viable populations of native and desired nonnative species and to achieve objectives for management indicator and focal species." The Columbia Basin Strategy (2000) identifies key elements to be addressed in planning efforts, such as source habitats, that are not addressed in the 1990 forest plans. The structural arrangement of vegetation, both vertical and horizontal, and the size and arrangement of trees, grasses, and shrubs are important components of wildlife habitat. Many changes to forest stand structure have occurred due to disturbances such as fire, timber harvest, and insects and disease. There has been a loss of large (20 inches d.b.h. and greater) and medium (15 to 20 inches d.b.h.) trees across the landscape. Within the dry upland forest, the amount of old forest single story has been greatly reduced from pre-1900 levels. Some of the most significant changes in forested structural stages have occurred in the dry upland forest environment. All of these changes have led to reductions in habitat for some species and increases for others. The 1990 forest plans need to be updated to reflect current science relating to plant and animal species and their habitats.

2. **To address management of fuels and fire risk.** Changing vegetative conditions have made forests more susceptible to disturbances, such as uncharacteristically severe fires, insects and disease. Several factors have contributed to the changes, including the cumulative effects of a periodic and sometimes extended drought, climate change, increasing vegetative density, shifts in forest species composition, and modified landscape patterns. Forested areas on the three national forests are dominated by dense, multi-storied conifer stands with tree species that are not well suited for the area. The 1990 forest plan standards and guidelines do not adequately address the multiple factors that have created the existing uncharacteristic conditions nor do they adequately address the varied nature of the landscape. Neither do they address the need for management strategies that recognize the unique qualities of various landscapes. An integrated strategy that recognizes multiple risk factors and addresses variability in conditions and site potentials is needed.

3. **To more adequately protect and restore watersheds and aquatic habitats.** The Columbia Basin Strategy (2000) emphasizes restoring the processes responsible for creating and maintaining aquatic and riparian habitats and restoring naturally functioning riparian ecosystems. It also outlines specific components to be included in revised forest plans. The 1990 forest plans include, by amendment, interim direction (i.e., PACFISH, INFISH, and the Eastside Screens) for management of threatened or endangered fish species. However, the 1990 plan language was never changed to integrate this interim direction or resolve conflicts between the existing plan language and the interim direction language. The 1990 forest plans do not adequately provide integrated management strategies for maintenance and restoration of properly functioning watersheds that provide a range of benefits on and off the national forests. These include, but are not limited to, providing habitat for terrestrial, aquatic, and riparian-dependent species; maintaining water quality; providing channel stability; reducing erosion; moderating floods; and maintaining reliable stream flows for downstream users.

4. **To address climate change.** The 1990 forest plans do not address climate change. Climate change is expected to affect plant species range and composition and alter competitive relationships between plant species. Changes in the composition and structure of plant

communities will, in turn, alter the character and distribution of wildlife habitats. Future conditions may be more favorable to some undesired nonnative plant and animal species. The full extent of changes in response to climate change on natural resources in the Blue Mountains is uncertain, but integrated management direction is needed to maintain or increase the resilience of the national forests in the face of these changes.

5. **To recognize the interdependency of social and economic components with national forest management.** The relationship between the national forests and the people who live, work, and play in them is not adequately recognized in the 1990 forest plans. National forests provide a variety of recreation opportunities, work opportunities, and opportunities to exercise cultural and spiritual traditions. Local communities provide infrastructure that contributes to the ability of the national forests to restore and maintain ecological systems. In eastern Oregon in particular, the tie between national forest management and the social and economic well-being of local communities is particularly important. With historically high unemployment rates and many small communities poorly positioned to attract new industries providing family wage jobs, logging and wood processing jobs are essential to maintaining and improving social and economic conditions. In addition, many of the actions needed to improve forest structure, reduce fuel loadings and conduct other restoration activities in eastern Oregon and Washington are dependent on the workforce and infrastructure associated with logging and wood processing.

# About the Planning Area

The three Blue Mountains national forests in northeast Oregon and southeast Washington provide the setting for the proposal (Figure 1). The project area (also called the plan area throughout this DEIS) consists of 4.9 million acres of National Forest System lands. The Forest Service administers the 1.5 million-acre Malheur National Forest and an adjoining 242,000-acre portion of the Ochoco National Forest as one unit; the 1.4 million-acre Umatilla National Forest; and the 2.4 million-acre Wallowa-Whitman National Forest. All of these National Forest System lands are in Oregon with the following two exceptions: the Umatilla National Forest includes 311,000 acres in southeast Washington and the Wallowa-Whitman National Forest includes the Hells Canyon National Recreation Area (HCNRA), which straddles the Oregon-Idaho border. The Analysis of the Management Situation (reflected in the 2004 Current Management Situation (CMS)) for the Hells Canyon National Recreation Area showed that there was no need for change in this area of the Wallowa-Whitman National Forest and therefore this area was not analyzed in this EIS. The 2003 Hells Canyon Comprehensive Management Plan EIS would be the guiding document for this portion of the Wallowa-Whitman, which is tiered to the 1990 Wallowa-Whitman National Forest Plan.

# Decisions to be Made

The regional forester for the Forest Service Pacific Northwest Region is the responsible official who will approve and sign three record of decisions, one for each National Forest—Malheur (including the portion of the Ochoco administered by the Malheur), Wallowa-Whitman and Umatilla National Forests.

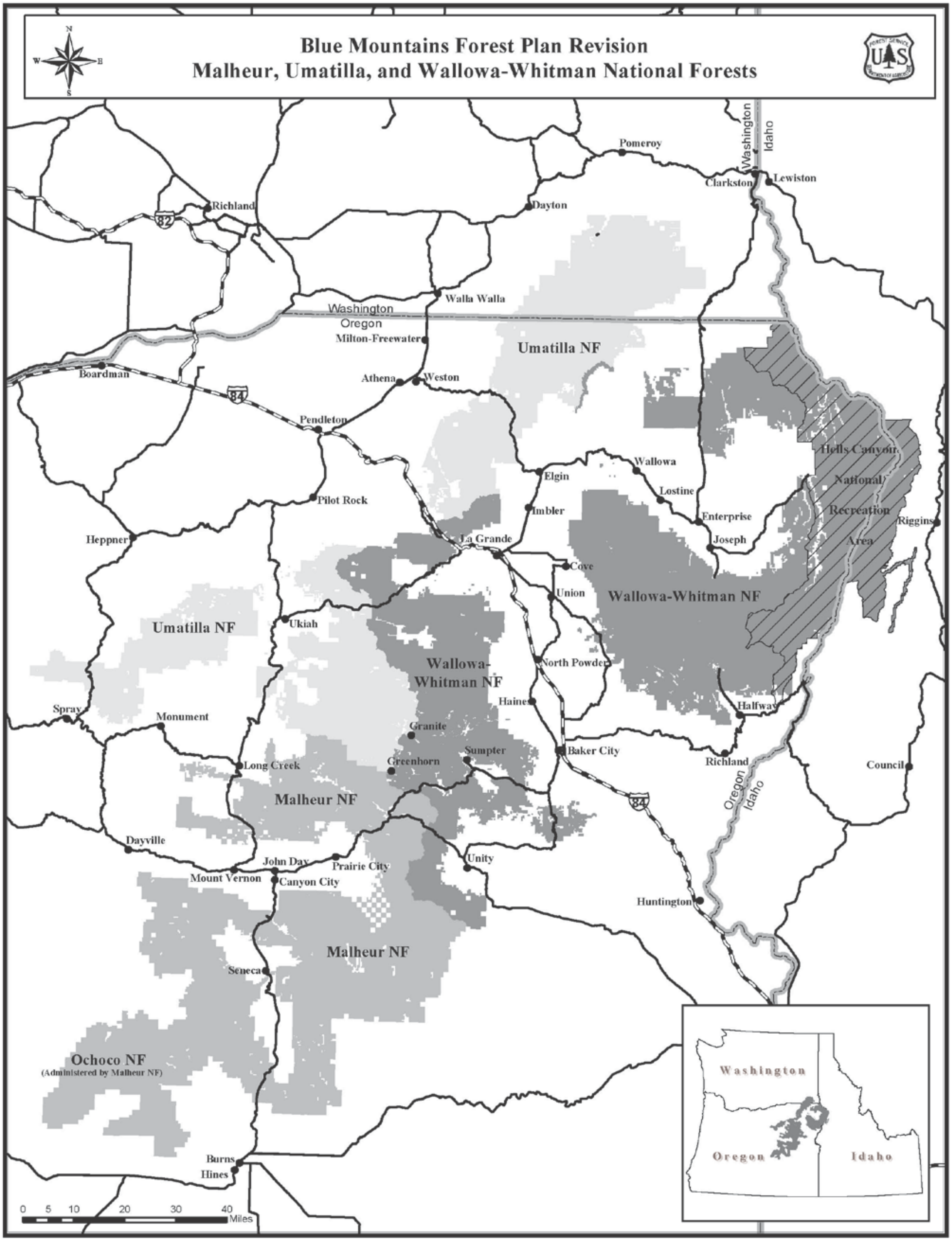


Figure 1. Vicinity map of the Blue Mountains national forests

Planning for units of the National Forest System involves two levels of decision making. The first level of planning involves the development of a forest plan that provides direction for resource management of the entire planning unit. Forest plans set out forestwide and management area direction with standards and guidelines for future decision making and are adjustable through amendment and revision. Forest plan management area and forestwide direction are the zoning ordinances under which future decisions are made. Forest plan approval establishes multiple-use goals, desired conditions, and objectives for the planning unit. Forest plan level actions are approval (16 USC 1604(d) and (j), amendment (16 USC 1604(f)(4)) and revision (16 USC 1604(f)(5)).

Forest plan approval results in:

- Establishment of desired conditions, forest multiple-use goals and objectives (1982 rule provision 36 CFR 219.11(b))
- Establishment of standards and guidelines applying to future activities (1982 rule provision 36 CFR 219.13 to 219.27)
- Establishment of management areas and management area direction applying to future activities in that management area, including the suitability of lands for resource management (16 USC 1606(g)(2)(A) and 1982 rule provision 36 CFR 219.11(c))
- Designation of suitable timber land (16 USC 1604(k) and 1982 rule provision 36 CFR 219.14) and establishment of allowable timber sale quantity (16 USC 1611 and 1982 rule provision 36 CFR 219.16)
- Recommendation to Congress of areas eligible for wilderness designation as required (36 CFR 219.17) and rivers eligible for inclusion in the National Wild and Scenic Rivers System as required (16 USC 1271-1287, 36 CFR 297, and 47 FR 39454)
- Establishment of monitoring and evaluation requirements (1982 rule provision 36 CFR 219.11(d))

For the Wallowa-Whitman National Forest, forest plan approval would complete the two wild and scenic rivers suitability analyses.

The second level of planning involves the analysis and implementation of management practices designed to achieve the goals, desired conditions, and objectives of the forest plan. Projects and activities are proposed, analyzed, and carried out within the framework of a forest plan and must be consistent with it. This second level involves site-specific analysis to meet NEPA requirements for decision making. The Blue Mountains forest plan revision does not include this second level of decision making.

## Decision Criteria

Decision criteria were identified by the forest supervisors for the Blue Mountains national forests and approved by the regional forester. These criteria will be used to evaluate the alternatives and determine which alternative ultimately will be selected:

- Meeting all applicable laws and regulations and be aligned with Forest Service policy
- Determining the balance between meeting the purpose and need with addressing the significant issues raised during the NEPA process
- Providing a mix of benefits to address the needs for change by:

  - Leading to more resilient and sustainable terrestrial ecosystems
  - Accelerating improvement of watershed and aquatic/riparian conditions
  - Restoring and maintaining scenery, cultural and recreation resources, treaty resources, and wildland-urban interface
- Minimizing conflicts between revised forest plans and travel management decisions
- Maintaining or enhance biological diversity and the long-term health of the national forests
- Contributing to economic and social needs of people, cultures, and communities

## Best Available Science

The best available science factors heavily into the decision. What constitutes best available science might vary over time and across scientific disciplines. As a general matter, we show consideration of the best available science when we insure the scientific integrity of the discussions and analyses in the project NEPA document. Specifically, the NEPA document should identify methods used, reference scientific sources relied on, discuss responsible opposing views, and disclose incomplete or unavailable information, scientific uncertainty, and risk. See 40 CFR, 1502.9 (b), 1502.22, 1502.24.

The Forest Service has a long history of science-based decision-making. Using scientific information in planning provides the responsible official with the knowledge, methods, and expert review needed to make an informed decision. To ensure that land management planning decisions help contribute to sustainable stewardship and ecological integrity of the nation's national forests, the agency has taken into account the best available scientific information pertaining to the economic and social conditions and ecosystem composition, structure, and function. In addition to other research, the scientific studies conducted by the Interior Columbia Basin Ecosystem Management Project (ICBEMP) (Quigley et al. 1996, Quigley et al. 1997) were considered in the development of this forest plan.

## Project Record

This DEIS incorporates by reference the project record (40 CFR 1502.21). The project record contains specialist reports and other technical documentation used to support the analysis and conclusions in this DEIS. The project record is available for review at the Wallowa-Whitman National Forest, Forest Supervisor's Office, 1550 Dewey Ave., Baker City, Oregon 97814.

# Proposed Action

The Forest Service proposes to revise the Malheur, Umatilla, and Wallowa-Whitman National Forests forest plans in accordance with the National Forest Management Act of 1976 and the 1982 planning regulations. The use of the 1982 planning regulations is allowed by the 2012 planning rule, which states at 36 CFR 219.35 that a responsible official may elect to continue or to initiate new plan amendments or revisions using the 1982 planning regulations.

The proposed action distributed for public review in March 2010 has been modified and is presented as alternative B and is described in chapter 2, and specific alternative components are provided in appendix A.

# Public Involvement

The notice of intent (NOI) to prepare this DEIS was published in the Federal Register on March 29, 2010 (FR, Vol. 75, No. 59). The NOI asked for public comment (written) on the proposal by May 25, 2010. In addition, the Forest Service held one round of public meetings during the scoping period in several towns in Oregon and Washington. Numerous collaborative meetings were held throughout the forest plan revision process (prior to the scoping period), which included several field trips. During the scoping period, the Blue Mountains forest plan revision team received 4,174 total responses to the request for comment and included in this total are 110 unique and substantially different comment letters and 4,025 organized form letters. The content analysis report analyzing all the comments received is located in the project record.

Additionally, alternative development meetings were held with representatives of industry and special interests groups, including wilderness advocates, conservation groups, and snowmobile enthusiasts, such as John Day-Snake River Resource Advisory Committee, Wallowa County Natural Resource Advisory Committee, Blue Mountains Forest Partners, Hells Canyon Preservation Council, etc. the details are available in the project record. Chapter 4 provides more information regarding consultation and coordination with the public, federal, state and tribal government entities.

# Issue Statements

The Blue Mountains forest plan revision team solicited comments from three primary sources and identified issues after reviewing the comments. The sources include:

1. The public via open houses, scoping letters, conversations, and meetings with special interest groups
2. Cooperating agencies, American Indian tribes, state and federal agencies, and collaborators, including the John Day-Snake Resource Advisory Committee and the Southeastern Oregon Resource Advisory Committee
3. Internal agency sources where discussions centered around changes in law and policy, changed conditions, and resource needs along with reviews of the proposed action

Potential issues were separated into groups per Council on Environmental Quality (CEQ) regulations (40 CFR 1500.1(b), 40 CFR 1500.2(g), and 40 CFR 1502.2(b)).

## Issues

Issues (cause-effect relationships) serve to highlight effects or unintended consequences that may occur from the proposed action, providing opportunities during the analysis to explore alternative ways to meet the purpose and need for the proposal while reducing adverse effects. To resolve concerns brought forward in the scoping process, the interdisciplinary team formulated alternatives, prescribed mitigation measures, or analyzed additional environmental effects that were not previously identified. At the forestwide planning level, mitigation measures are incorporated into management direction (goals and objectives, desired conditions, standards and guidelines) or management prescriptions that influence the type, amount, and intensity of management actions that implement the forest plan or covered by laws, rules and regulations not addressed in the forest plan. The issues were developed to respond to conflicts with the proposed action that was distributed for public review in 2010. The responsible official selects issues for revision based on one or more of the following criteria:

- Would these issues be used to help develop management alternatives or management direction or would they be used in the allocation of management prescriptions?
- Would management alternatives, direction, or prescriptions have discernible effects on the issues or related resources?
- Would effects to the issues be sufficiently different by alternative to provide the responsible official with rationale for choosing a preferred or selected alternative?

## Key Indicators

Key indicators are measureable indicators of change linked to significant issues. Indicators associated with each issue have a cause-and-effect relationship and provide means to assess how the alternatives respond to those issues.

## Issues that Drive Alternative Development

### Issue 1: Access

**Public Concern:** While some people suggested allocating additional areas to undeveloped backcountry to satisfy needs, such as solitude and nonmotorized recreation, others requested that additional areas be designated to allow motor vehicle recreation and requested that what is currently available not be reduced.

**Statement:** While the forest plan will not change designations of roads and trails for motor vehicle use, it will provide direction for future planning of motor vehicle routes and areas. In addition, the forest plan designates areas where the dominant uses are nonmotorized, which restricts the potential for development of motor vehicle access. It also designates areas where development for motor vehicle use could be considered. Motor vehicles are used for hunting and fishing, summer and winter recreation, private land access, management activities, and fire suppression. Nonmotorized areas are used for hunting and fishing, summer and winter recreation, secluded wildlife habitat, and biological reserves. The number of acres suitable for motor vehicle use and the desired conditions for open motor vehicle route density will influence the future transportation system and future road closure or development opportunities. These acres are an important factor affecting the health of terrestrial, aquatic, and riparian habitats. With the exception of wilderness areas, the forest plans for the Wallowa-Whitman and Malheur National Forests include little management direction to distinguish motor vehicle use allocations from nonmotorized use allocations, although the forest plan for the Umatilla National Forest included detailed management direction related to motor vehicle use. Subsequent to the Umatilla National Forest 1990 land management plan decision, each District on the Umatilla National Forest made Access and Travel Management Decisions, leading to the production of a forestwide Motor Vehicle Use Map (USDA Forest Service 1990, 1992, 1993a and 1993b). An additional concern with regards to access is that the road maintenance projections for the 1990 forest plans were not accomplished. Objectives for maintenance of the road system that are consistent with expected budgets are needed.

*Key Indicators:*

- Road maintenance funds projected to be available to maintain the transportation system
    - ♦ Projected road maintenance for each road maintenance level (miles)
- National Forest System lands that would be suitable for motor vehicle route designation and use or suitable only for nonmotorized use (acres)

- ♦ Change in acres suitable for summer motor vehicle route designation and use
- ♦ Change in acres suitable only for summer nonmotorized use (where motor vehicle use would be prohibited)
- ♦ Change in area suitable for winter over-the-snow motor vehicle use

### **Issue 2:** Economic and Social Well-being

**Public Concern:** Many people stressed the importance of economic and social contributions of the national forests to the surrounding communities. One concern is the importance of maintaining the infrastructure in local communities (e.g., mills, roads, equipment, and skilled labor force), so that the Forest Service can draw upon that infrastructure to accomplish restoration goals as well as contribute to the economic and social well-being of communities. Another concern is the potential effects of large disturbances, such as insects and disease or wildland fire, on the economic and social well-being of local communities. Other people stressed ecological values and suggested that a more cautious approach and mix of restoration activities is necessary to protect those values that also contribute to economic and social well-being.

**Statement:** Forest plan decisions create the framework for the range of uses and products and services provided by the Blue Mountains national forests that contribute to the economic and social well-being of local communities, counties, and American Indian tribes. The quantity and quality of forest products and services provided by the national forests contribute to the local economy and the maintenance of local infrastructure. Infrastructure and the local workforce, in turn, play a critical role in the capacity of national forests to conduct forest management activities. The mix of uses, products, and services the Forest Service expects to provide over time will be stated in the forest plans.

*Key Indicators:*

- Jobs and income for the following sectors:
  - ♦ Timber
  - ♦ Grazing
  - ♦ Recreation
  - ♦ Ecosystem restoration
- Predicted harvest levels
- Allowable sale quantity

### **Issue 3:** Livestock Grazing and Grazing Land Vegetation

**Public Concern:** Several people expressed concern about how revised forest plan direction will affect livestock operations and livelihoods. They expressed that further restrictions on allotments that are already financially overburdened due to high maintenance and operation costs would have significant financial and social effects. Other comments were made about the effects of permitted livestock grazing on National Forest System lands and resources. Most concerns revolved around riparian area livestock use and its effect on fisheries, biodiversity, and water quality. The viability of bighorn sheep due to the potential for disease transmission between domestic sheep and bighorn sheep is also a concern.

**Statement:** Suitability of areas for livestock grazing (both cattle and sheep) is identified in forest plans. Forest plans also set limitations on activities, including permitted livestock grazing, for the protection of resources. The decisions made in forest plans do not determine the number of permitted livestock or the season, timing, or duration of use. The number of acres suitable for livestock grazing, along with the need to maintain and restore upland and riparian conditions and viable populations of fish and other species, may influence the location and amount of domestic livestock grazing that occurs on the national forests. Actual decisions regarding permitted livestock grazing will be made at the site-specific project level.

*Key Indicators:*

- Area suitable for permitted cattle and sheep grazing (acres)
- Permitted cattle and sheep animal unit months (AUMs)
- Rate of progress towards achieving rangeland vegetation desired conditions

### **Issue 4:** Old Forest

**Public Concern:** Many people suggested an active approach to reducing the risk of loss from insects and disease and wildland fire within old forest stands and accelerating the development of old forest structure. Other people prefer the use of nonmechanical means to restore old forest stands and the designation of old forest management areas.

**Statement:** Old forests are unique components of a diverse vegetative community. They are important for their aesthetic qualities, wildlife habitat, carbon storage, ecological importance, and value as commercial products. Restrictions on harvesting large trees are in place from the 1990 forest plans and the Eastside Screens. The Blue Mountains national forests generally have less old forest than what occurred historically, especially in the dry upland forest, single story, open canopy stage. The forest plan will determine how much old forest the Blue Mountains national forests should have in the future and how it should be managed to ensure the ecological, social, and economic values it provides.

*Key Indicators:*

- Acres of old forest within management area allocations with limited management activity
- Acres of vegetation treatments within old forest
- Change in old forest structure through time

### **Issue 5:** Preliminary Administratively Recommended Additions to the National Wilderness Preservation System

**Public Concern:** Many people asked that additional areas be proposed for wilderness designation to protect the values that they attach to wilderness areas. Others requested that no additional areas be proposed for wilderness designation because this would prevent them from participating in the activities that they currently enjoy within those areas. Wilderness designation would also limit management activities that could provide economic benefits while reducing the risks of uncharacteristic wildland fire and insects and disease disturbances.

**Statement:** Wilderness area designation is an allocation of land to a specific use. Proposals are preliminary administrative recommendations that require further review and possible modification by the Chief of the Forest Service, Secretary of Agriculture, and the President of the United States. Congress has reserved the authority to make final decisions on wilderness area designation. Wilderness area designation precludes the use of motor vehicles and motorized and mechanized equipment and most management activities. Wilderness areas offer human visitors solitude and opportunities for challenge, risk, and primitive recreation. Natural processes, including disturbances and ecological succession, operate without human intervention. Plant and animal habitats are undisturbed by human uses. The 1990 forest plans do not include recommendations for wilderness designation. Based on a review of the 1990 forest plans with respect to management of existing wilderness areas, the ID team did not recommend, nor did the forest supervisors determine a need for change. Refer to the analysis file for documentation of this review.

*Key Indicator:*

- Acres allocated to MA 1B Preliminary Administratively Recommended Wilderness Areas

### **Issue 6:** Ecological Resilience

**Public Concern:** There is concern about the type and extent of management activities for restoring ecological resilience that are included in the proposed action. Based on perceptions of current vegetation conditions and its resilience, some respondents stated that the proposal is too aggressive, while others stated that the restoration proposal not aggressive enough. Public concern is heightened because the management approach to restoring ecological resilience will determine the ecosystem services the Blue Mountains national forests provide.

**Statement:** Agency policy to reestablish and retain ecological resilience (FSM 2020) was developed subsequent to the approval and signing of the 1990 forest plans. Resilience is defined as the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change (FSM 2020 interim directive). While the foundational policy for the national forests is to achieve sustainable management and provide a broad range of ecosystem services, forest plans determine the management approach by defining objectives, desired conditions, standards and guidelines, and predicting outcomes. Climate change is likely to result in consequences for all resources and is part of the baseline condition. Climate change is included in the cumulative effects analyses throughout chapter 3 of this DEIS.

*Key Indicators (to reflect the level of management activity):*

- Annual forested vegetation active restoration activities (acres)
- Roads treatments in priority watersheds (miles)
- Forage use in priority watersheds (intensity)
- Improved riparian areas (miles)

*Key Indicators (to reflect resilient conditions)*

- Watersheds in improved conditions
- Improvement in the dry upland forest potential vegetation group fire regime condition class departure score at year 50 and change from existing condition

## Other Resource Area Concerns Addressed in the Plan

### Eligible Wild and Scenic Rivers

Many people expressed the desire for additional designations in accordance with the Wild and Scenic Rivers Act. The 1990 forest plans were challenged by the American Rivers and the Pacific Rivers Council with respect to how the plans addressed rivers and streams with potential to be included in the Wild and Scenic River System. To resolve those challenges, various eligibility and suitability studies were completed by the Forest service.

Determination of eligibility is an inventory process that follows agency procedures available from the Forest Service Handbook 1909.12, chapter 82. These eligibility inventories will remain in place until changed by subsequent reinventory. These inventories do not require NEPA analysis unless eligible lands from the inventory are assigned to a management area. Based on those eligibility inventories, this plan revision effort would allocate lands adjacent to eligible rivers to MA 2A (Designated and Eligible Wild and Scenic Rivers) in the action alternatives described in chapter 2 and appendix A.

Determination of suitability is a decision process that follows agency procedures available from the Forest Service Handbook 1909.12, chapters 82 and 83. The suitability process and decision may occur as part of a forest plan revision or may be deferred to a subsequent analysis. In 1996 and 1997, the Forest Service analyzed the suitability of additional eligible rivers on the Wallowa-Whitman National Forest; determining that 3 of 11 rivers were suitable for recommendation to Congress for inclusion in the Wild and Scenic River System. There are currently 10 Wild and Scenic Rivers on the Wallowa-Whitman National Forest. In response to the proposed action, public comments supported including additional suitability determinations in the revision effort. Such efforts will be deferred and are not part of the scope of this analysis.

### Climate Change

Climate change concerns were included in several comments. It is Forest Service policy to consider the effects of climate change during forest plan revisions. Climate change analysis is part of the design of the ecological desired conditions for all alternatives. Climate change is likely to impact all vegetation types and result in consequences for all resources and is part of the evolving baseline condition. Climate change is included in cumulative effects analyses throughout chapter 3 of this DEIS.

### Energy Development

Some people expressed concern about potential energy developments within the national forests. Wind energy development is of the highest concern. Wind energy development is considered a special use of the national forests. All special uses must be consistent with forest plan components, including desired conditions for scenery, watershed function, species diversity, cultural resources, and water quality. Special use proposals must undergo site-specific analyses that will determine their consistency with the forest plan. A few people commented on the potential for oil and gas development on the national forests. Oil and gas availability and leasing determinations are not made during forest plan revision and are not a forest plan decision. A suitability determination for energy development will be included in the forest plan.

### Rocky Mountain Elk

Rocky Mountain elk are an important resource within the Blue Mountains national forests, both biologically and socially. The action alternatives address Rocky Mountain elk by proposing a common desired condition to move the landscape, and thus elk habitat, toward the natural range of variability. Cooperation with state wildlife agencies is needed to manage Rocky Mountain elk populations in the manner needed to achieve the desired condition. Even though the alternatives share a common desired condition, the analysis displays a wide range of effects on elk as significant issues are responded to in different ways. The effects of habitat patterns and how the absence or presence of motor vehicles relate to Rocky Mountain elk for each alternative are discussed in chapter 3. Since Rocky Mountain elk are considered a habitat generalist and because each alternative addresses the significant issues differently and provides varying levels of habitat and security for Rocky Mountain elk, they are not considered a significant issue.

## Wildlife Habitat Connectivity

People expressed concern about the need to identify wildlife habitat connectivity in the forest plan. This concern was addressed in several different ways in the proposed action. Areas where most types of active management are generally not suitable will provide varying amounts of wildlife habitat connectivity. Riparian management areas also function as wildlife corridors for some species. Alternative C includes designation of a management area to provide for wildlife corridors. Alternatives E and F also have minor acreages identified for management as connections of wildlife habitat. The effects analysis in chapter 3 describes how each alternative contributes to the connectivity of habitats for various wildlife species.

## Access for People with Disabilities

Many people commented that denial of motor vehicle access to people with disabilities violates the Americans with Disabilities Act (ADA). ADA defers to Section 504 of the Rehabilitation Act of 1973, which says that no person with a disability can be denied participation in a Federal program available to all other people solely because of his or her disability. In conformance with section 504, wheelchairs or mobility devices are welcome on all National Forest System lands that are open to foot travel, and they are specifically exempted from definition as a motor vehicle in section 212.1 of the Travel Management Rule (36 CFR 212.1). There is no legal requirement to allow people with disabilities to use off highway vehicles (OHVs) or other motor vehicles on roads, trails, and areas closed to motor vehicle use. Reasonable restrictions on motor vehicle use, applied consistently to everyone, are not discriminatory. This concern has been decided by law.

## Budget

Many people commented that the objectives in forest plans should not be constrained by budget, but rather should state levels needed to achieve the desired conditions. They expressed fears that budget-constrained objectives will create a ceiling and will not clearly outline the restoration needs. It is not realistic or reasonable to ignore expected funding levels. Increases in budgets beyond expected levels could result in a faster rate of achievement of the desired conditions than those projected. Recent budget trends are essentially level or slightly declining and those trends are expected to continue. The forest plan does not influence or control the budgets for the national forests, but the alternatives analyzed in this document include varying budget levels for some program areas based upon the themes of the alternatives and how the alternatives would address the various issues.

## Fees

The topic of fees for a variety of national forest products and uses was raised by some people. Fees are an administrative decision and are outside the scope of a forest plan.

## Revised Statute (RS) 2477 Public Right of Way

Some people commented that some roads on the national forests are public roads under RS 2477 and should be recognized as such. The Forest Service recognizes legally documented rights-of-way held by state, county, or other public authorities. This includes rights-of-way under RS 2477 that have been adjudicated through the Federal court system or otherwise formally established, such as easements under the Federal Roads and Trails Acts (FRTA). The only means to conclusively establish the existence of a RS 2477 right-of-way across Federal land is by obtaining a judgment from a Federal court under the Quiet Title Act (28 U.S.C. section 2409a).

Since an assertion on National Forest System lands is a claim of title against the Federal government, an RS 2477 claim must be asserted by a state or county government that manages a public road system. Individuals who wish to pursue an RS 2477 claim must present their request to the local county government for consideration. The Forest Service may manage or agree to manage (in accordance with the local public road agency) any road declared under a validated claim consistent with a Forest Service approved travel management plan. Management may include a range of options, including designation for highway legal vehicle or OHV use; changing the level, type, or season of use; or removing these routes from designation in the Forest Service approved travel management plan. This would not preclude establishment of the route as a public right-of-way in the future if a court were to make a determination of validity. Due to the limited role of RS 2477 rights-of-way in the forest plan revision process, this issue does not involve discernible effects and is outside the scope of this analysis.

### Travel Management Planning

Many people asked that the Travel Management Rule be set aside or that the Forest Service modify decisions being made outside of forest plan revision to designate roads, trails, or areas for motor vehicle use. Some people would like the national forests to allow cross-country travel. The Travel Management Rule (36 CFR 212, Subpart B) directs each national forest to designate roads, trails, or areas for motor vehicle use. The Forest Service has completed Travel Management Rule Subpart B designations for the Umatilla, while travel management planning and compliance with Subpart B of the rule is ongoing for the Wallowa-Whitman and Malheur National Forests. This designation of roads, trails, or areas for motor vehicle use is site-specific. The forest plan does not make the site-specific decisions required by the Travel Management Rule, and it cannot set the rule aside or ignore it. The revised forest plans will provide the framework for future transportation system decisions to be made but will not make decisions that designate roads, trails, or areas for motor vehicle use. Look for further explanation under the legal and regulatory framework section.

## Legal and Regulatory Framework

Over time, a framework of laws, regulation, and guiding legislation that works to guide the management of National Forest System lands has been enacted. Legal mandates governing national forest management date back to the Organic Act of 1897, which provided that national forests would be managed for the dual purpose of protecting water flows and providing a continuous supply of timber for the American public. The Multiple Use Sustained Yield Act (1960) provides for the sustainability of the multiple uses of natural resources in ways that best meet the needs of the public while maintaining the long-term productivity of the land for multiple uses and in such a manner that these lands are available to future generations. The magnitude and intensity of any effects are disclosed to the public, and the public has the opportunity to comment on the actions proposed. The National Forest Management Act 1976 and its accompanying legislation guides the creation, revision, and amendment of National Forest Land Management Plans, and the Forest and Rangeland Renewal Resources Planning Act of 1974 directs that the suitability of lands for resource management be identified and a process for the revision of land and resource management plans established. This revision process was conducted under the legal framework of the National Forest Management Act, and the provisions of the 1982 Planning Rule, as allowed by the 2012 Planning Rule language (36 CFR 219.7(b)(3)). NFMA requires forest plans to be revised at least every 10 to 15 years or sooner if warranted by changed conditions. The multiple-use desired conditions and objectives, design criteria (standards and guidelines), and monitoring all work together to define management direction for the three Blue Mountains national forests. However, successful implementation of the management direction and the rate of accomplishment of desired conditions are dependent upon the congressional budget process and other factors.

The National Environmental Policy Act (NEPA) of 1969 requires that all major Federal actions significantly affecting the human environment be analyzed, and the consequences to the quality of the human environment from proposed management actions are to be considered. The regulations implementing the NEPA further require that agencies prepare environmental impact statements concurrent and integrated with environmental analysis and related surveys and studies required by such laws as the Endangered Species Act of 1973, the National Historic Preservation Act of 1966, the Wilderness Act of 1964, and the Wild and Scenic Rivers Act of 1968. Other environmental review laws and executive orders, such as the Clean Air Act of 1977 and the Clean Water Act of 1948 are also considered.

The revised forest plans will continue to honor American Indian reserved rights through consultation and coordination, and will maintain a government-to-government relationship with federal recognized tribal governments.

Additional direction for managing National Forest System lands comes from a variety of sources, including Executive Orders (EOs), the Code of Federal Regulations (CFRs) and the Forest Service directive system, which includes the Forest Service Manual (FSM) and the Forest Service Handbook (FSH). This management direction is generally not repeated in the forest plan.

Appendix D of this DEIS lists many of the laws, regulations, executive orders, and other guiding direction for the scope and content of analysis for each section of chapter 3.

# Relationship to Other Assessments

There are broad scale assessments in place that affect management decisions for the Blue Mountains national forests. These assessments are referenced in this chapter to explain the revision process in the context of these larger analyses. National Forest System lands within the Blue Mountains plan area were considered along with lands managed by other Federal agencies, tribal lands, state, and private lands to the extent possible for all resources.

## National Scale

The Department of Energy, Bureau of Land Management (Department of the Interior), the Forest Service (Department of Agriculture), and Department of Defense issued a final programmatic environmental impact statement (PEIS) that documents the evaluation of issues associated with the designation of energy corridors on Federal public lands in 11 western states. Based on the PEIS findings, no energy corridors were identified on national forest lands within the Blue Mountain national forests. The subsequent USDA record of decision (USDA Forest Service 2009) did not amend the Blue Mountain national forest's land and resource management plans to reflect the PEIS energy corridor designation. Further information about the PEIS is available at http://corridoreis.anl.gov.

## Regional Scale

The Interior Columbia Basin Ecosystem Management Project (ICBEMP) responds to presidential direction to develop a scientifically sound, ecosystem-based strategy for management of 64 million acres of lands administered by the Forest Service and the Bureau of

Land Management within the Columbia River Basin and portions of the Klamath and Great basins in Oregon. ICBEMP analysis also responds to concerns about forest and rangeland health, uncharacteristically intense wildland fires, threats to certain fish and wildlife species, and concerns about local community social and economic well-being. In addition, there was little broad-scale scientific knowledge of the ecological, biophysical, social, and economic conditions, trends, risks, and opportunities within the plan area.

The Eastside Ecosystem Management Project Charter was the catalyst for ICBEMP in January 1994. The charter, signed by the Chief of the Forest Service and the Director of the Bureau of Land Management, directed the agencies to develop and adopt a scientifically sound, ecosystem-based strategy for managing all Forest Service and BLM administered lands within the basins. A scientific assessment of the basins provides a better understanding of the scope and possible broad-scale causes of current resource conditions. The scientific findings formed the basis for management strategies evaluated for ICBEMP.

A final environmental impact statement and proposed decision were published in December 2000. Rather than prepare a record of decision, in 2002, the BLM state directors and Forest Service regional foresters chose to incorporate ICBEMP's scientific data and resource information into land and resource management plans and project implementation (FS Agreement No. 03-RMU-11046000-007).

## Forestwide Scale

### Analysis of the Management Situation

An analysis of the management situation (AMS) was completed for the Blue Mountains national forests. The AMS summarizes information about the conditions of the land and peoples' uses and values associated with it. This provides the foundation for developing a proposal for future management of the Blue Mountains national forests. It paints a picture of the current social, ecological, and economic setting and helps define the decision space. It identifies where and why there is a need to change the 1990 forest plans and what needs to be addressed in this revision.

The AMS is not a decision document. It has been prepared in accordance with the requirements of the 2012 planning rule (1982 planning rule provisions 36 CFR 219) and the Forest Service Handbook (FSH 1909.12) that require an analysis of the management situation. It documents the current management situation, conditions, and trends with regard to the components of the 1990 forest plans and it identifies any need for change in those plan components.

### Oil and Gas Leasing

A potential natural gas resource occurs in Mesozoic age rocks beneath the Malheur and Umatilla National Forests. As required by Forest Service regulations, an analysis was completed in 1997 that identified lands administratively available for oil and natural gas leasing within the Malheur and Umatilla National Forests. This decision is incorporated into the existing forest plans by amendment. Lands excluded from the analysis include lands withdrawn from mineral entry or leasing. Wilderness areas, recommended wilderness areas, and wilderness study areas are legally unavailable for leasing. Those parts of the Snake River basin within the Umatilla National Forest and congressionally designated areas of the national forests are also unavailable. All other lands within these national forests are considered administratively available for oil and gas leasing, subject to one or more of four basic lease stipulations: no surface occupancy, seasonal use, controlled surface use, or standard lease stipulations. The 1997 leasing decision will be carried forward into the revised plans for the Malheur and Umatilla National Forests; however, when specific lands are proposed for lease, the Forest Service would review the existing leasing decision to ensure adequacy of NEPA compliance, consistency with the forest plan, and proper application of lease stipulations.

## Hells Canyon National Recreation Area

The Hells Canyon National Recreation Area Act (Public Law 94-199) required that a separate management plan be developed for the Hells Canyon National Recreation Area. The Hells Canyon National Recreation Area Comprehensive Management Plan was subsequently developed and was approved on April 30, 1982. When the 1990 forest plan for the Wallowa-Whitman National Forest was approved, this HCNRA CMP was carried forward without amendment under the provisions of the 1982 planning rule (1982 rule provision 36 CFR 219.12(b)) which state that "(if), in a particular case, special area authorities require the preparation of a separate special area plan, the direction of any such plan may be incorporated without modification in plans prepared under (these regulations)." In 2003, the HCNRA CMP was revised and, by amendment, became part of the 1990 forest plan for the Wallowa-Whitman National Forest. This 2003 Hells Canyon National Recreation Area Comprehensive Management Plan is being carried forward without modification and will continue to be a part of the forest plan for the Wallowa-Whitman National Forest.

The 662,000-acre Hells Canyon National Recreation Area includes about 30,000 acres of lands that are not part of the National Forest System. The Hells Canyon National Recreation Area is managed via its own enabling legislation and comprehensive management plan EIS (USDA Forest Service 2003). The Hells Canyon National Recreation Area Comprehensive Management Plan EIS was reviewed by the plan revision interdisciplinary team in 2004 to determine if there was a need for change to revise that plan. The Analysis of the Management Situation (reflected in the 2004 Current Management Situation (CMS)) for the Hells Canyon National Recreation Area showed that there was no need for change in this area of the Wallowa-Whitman National Forest and therefore this area was not analyzed in this EIS. Based on the recommendation of the interdisciplinary team, the Wallowa-Whitman National Forest's forest supervisor and the Region 6 regional forester determined that no new information or changed conditions existed that would provide a need to revise the Hells Canyon National Recreation Area Comprehensive Management Plan EIS. Thus, that management direction would remain unchanged by this revision effort. The 2003 Hells Canyon National Recreation Area Comprehensive Management Plan EIS would be the guiding document for this portion of the Wallowa-Whitman, which is tiered to the 1990 Wallowa-Whitman National Forest Plan. The 4.9 million-acre project area referred to throughout this DEIS excludes the HCNRA. Where appropriate (for instance, in the analysis of cumulative effects for some resources), the resources within HCNRA were included.

## Wilderness, Wild and Scenic River and Other Plans

Some amendments to the 1990 forest plans and other resource management decisions resulted in the creation of management and activity plans for specific designated management areas. These would be carried forward in this revision effort unchanged. These plans are currently tiered to the 1990 forest plan, but once the revised forest plan decision is in place, those plans would tier to the revised forest plans. These plans include wilderness plans, wild and scenic river plans, research natural area plans, and so forth. The one exception to this is the Hells Canyon Wilderness Area Plan, which would continue to be tiered to the 1990 forest plan, for the reasons previously discussed. These various plans continue to be effective at maintaining, enhancing, and protecting the specific designated management areas. In this planning effort, the forests brought forward many of the plan components that were in the individual plans. Unless specifically identified in the revised forest plan, the actions of these management plans would continue to be used for the future management of these specific designated management areas.

## Invasive Plant Treatment Projects

In 2005, the Pacific Northwest Regional Forester amended all forest plans in Region 6, adding new management direction, including an emphasis on early detection, and effective integrated treatment of invasive plants. EISs and associated decisions have been prepared on the Wallowa-Whitman and the Umatilla National Forests to allow the Forests to control invasive plant species using the amended forest plan direction. These decisions allow for effective treatment of invasive plants on all sites currently mapped and those that may be detected in the future. Initial treatments rely more heavily on herbicides; but the goal, as invasive plant objectives are met, is to reduce the use of herbicides over time. The Malheur National Forest Site-Specific Invasive Plants Treatment is currently underway.

## Travel Management Planning

Land management plans are strategic and aspirational, establishing desired conditions, objectives, suitability of areas for various uses, and guidelines (FSM 1920). Travel management decisions are made at the project level; they are site-specific decisions that are not typically made in land management plans, which are programmatic documents. Travel analysis (36 CFR 212.51(a)) provides a bridge between the strategic guidance in land management plans and travel management decisions made at the project level.

In December 2005, the Forest Service issued a regulation known as the Travel Management Rule (36 Code of Federal Regulations (CFR) Parts 212, 251, 261, and 295). The Travel Management Rule clarifies current Forest Service policy regarding motor-vehicle use and provides management direction that allows sustainable access by motor vehicles, including OHVs, on national forests and grasslands.

The Travel Management Rule requires each national forest and grassland that does not have a designated motorized travel system to establish one and for that system to be documented on a publicly available motor vehicle use map that will be updated annually. Designations to motorized travel systems may include the limited use of motor vehicles within a specified distance (corridor) of certain designated National Forest System roads solely for dispersed camping or big game retrieval (36 CFR 212.51(b)). Once a motor vehicle use map is published, all motor-vehicle travel that is inconsistent with its designations is prohibited (36 CFR 261.13).

With the exception of wilderness areas, the forest plans for the 1990 Wallowa-Whitman and Malheur National Forests include little management direction to distinguish motor vehicle use allocations from nonmotorized use allocations; however, the forest plan for the Umatilla National Forest included detailed management direction related to motor vehicle use. Subsequent to the Umatilla National Forest 1990 land management plan decision, each District on the Umatilla National Forest made Access and Travel Management Decisions (USDA Forest Service 1990, 1992, 1993a and 1993b), leading to the production of a forestwide motor vehicle use map in compliance with 36 CFR 212.51, Subpart B and 36 CFR 216.13 of the Travel Management Rule.

### Allotment Management Plans

The forest plan provides guidance for the rangeland resource and livestock grazing program. Project level NEPA decisions determine specific standards and guidelines, desired conditions, livestock numbers and pasture rotations for a specific allotment. That decision is captured in the Allotment Management Plan (AMP), which is incorporated into the Term Grazing Permit as part of the management direction for the allotment. Annual Operating Instructions (AOIs) are issued to identify changes to the allotment management including pasture rotation, season or livestock numbers, range betterment projects, etc. for a given year. Current AMPs are tiered to the 1990 forest plan. Once the revised forest plan decisions are implemented, the forests will incorporate the new management direction as a Modification to the Term Grazing Permits, as well as in the AOIs until new NEPA can be conducted.

## Landscape Scale

Several watershed assessments at the subbasin or watershed scale have been completed since the 1990 forest plans were completed. Subbasin plans were developed collaboratively by state and Federal fish and wildlife agencies, American Indian tribes, local planning groups, and fish recovery boards. The planning effort was guided by the Northwest Power and Conservation Council and funded by the Bonneville Power Administration. Subbasin plans identify priority restoration and protection strategies for habitat and fish and wildlife populations in the United States portion of the Columbia River system. The plans will guide the future implementation of the council's Columbia River Basin Fish and Wildlife Program, which directs more than $140 million per year of Bonneville Power Administration electricity revenues to protect, mitigate, and enhance fish and wildlife affected by hydropower dams. Subbasin plans will provide this guidance by providing the context for proposed project review for funding through the council's program. Subbasin plans were finalized in 2005 for all subbasins within the project area except for Silver Creek and Silvies River within the Malheur National Forest. The completed subbasin plans are available at the Northwest Power and Conservation Council website.[1]

Watershed assessments at the 5th-field hydrologic unit code (HUC) watershed scale have also been completed since 1990. Not all watersheds have been assessed. Umatilla National Forest watersheds with completed reports are available on the Umatilla National Forest website[2] under "Land and Resources Management Planning." Watershed assessments for the Wallowa-Whitman and Malheur National Forests are available in the project record.

[1] http://www.nwcouncil.org/fw/subbasinplanning/home/
[2] http://www.fs.usda.gov/detail/umatilla/landmanagement/planning/?cid=fsbdev7_016111

# Chapter 2. Alternatives, Including the Modified Proposed Action

This chapter describes and compares the six management alternatives for revising the 1990 forest plans for the national forests of the Blue Mountains. The alternatives were developed based on public involvement both during and prior to the scoping period for the proposed action and based on the purpose and need and issues described in chapters 1 and 4. The alternatives present a range of analysis options, as required by National Environmental Policy Act (NEPA) regulations (40 CFR 1502.14).

NEPA requires that an environmental impact statement include analysis of the no-action alternative (40 CFR 1502.14(d)). No action means that there would be no change in current management (FSH 1909.15(14.2)). Alternative A is the no-action alternative. This alternative would keep the 1990 forest plans as amended in effect. The action alternatives (alternatives B, C, D, E, and F) modify components of the 1990 forest plans to respond to new scientific information, management challenges, changed conditions, and the significant issues developed from public comments.

The alternatives provide a framework for analyzing different ways of meeting the purpose and need of the forest plans and for addressing the issues described in chapter 1. These alternatives show a range of options for guiding land and resource management activities on the national forests of the Blue Mountains during the life of the plan. While this draft environmental impact statement identifies a preferred alternative, the key purpose of this document is to describe in detail the environmental consequences of implementing any one of the alternatives.

Following publication of this draft environmental impact statement, there will be a 90-day period for public comment. Adjustments based upon public comment may be made to one or more of the alternatives. A subsequent evaluation of the modified alternatives will occur as part of the preparation of the final environmental impact statement and the final revised forest plans. The record of decision will indicate the selection of one of these final alternatives as the basis for the final set of forest plans for the Malheur, Umatilla, and Wallowa-Whitman National Forests.

Appendix A is a detailed description and comparison of the alternatives considered in detail.

## Developing the Alternatives

The alternatives include different options to address significant issues and to respond to the purpose and need discussed in chapter 1. The public; other Federal, state, and local agencies; and Forest Service employees contributed to the identification of the significant issues that are addressed by the alternatives compared in this draft environmental impact statement. Using an interdisciplinary approach, the Forest Service used the significant issues as the primary basis for developing the action alternatives. While all alternatives provide a range of multiple uses and goods and services, each responds to the significant issues in different ways.

Public participation that is ongoing, including collaborative workshops, field trips, meetings, and comments received during the scoping period, helped focus the issues and the scope for alternative development. The Blue Mountains forest plan revision team developed the alternatives in response to significant issues and the purpose and need for change, and these were approved by the regional forester. The alternatives considered fall within the range of the minimum and maximum resource potentials established in the benchmark analysis required by regulation (1982 planning rule provisions 36 CFR 219.12(e)(1)).

The "Decisions to be Made" section of chapter 1 outlines the six decisions made in a forest plan. These six items are the components of the forest plans. All alternatives include these components. The differences between the alternatives are based on how they respond to the issues described in chapter 1 relative to the plan components.

# Description and Comparison of the Alternatives

The following sections describe and compare the alternatives. For each alternative, the description begins with the alternative theme and is followed by the description of how the alternative responds to the issues. The alternatives are also described in the context of other resource areas not already addressed by the issues. This section ends with a comparison of the alternatives.

Appendix A provides a detailed description of the alternatives, including the No-action alternative. Appendix A will form the basis of the forest plan. The draft forest plan is based on the preferred alternative, to give the public an idea of what the plan will look like after the decision. Appendix A provides the full details for the range of alternatives, which forms the basis for the effects analysis in chapter 3. The alternatives are comprised of desired conditions, standards, guidelines, management areas, objectives, suitability and monitoring. The appendix and glossary define these plan component terms and provide more details on what these components are comprised of and what they mean in forest planning.

At the end of this chapter, key issue descriptions are presented for the three national forests as a whole to facilitate comparison of the alternatives (tables 3, 4, and 5).

# Elements Common to the Action Alternatives

## Plan Components

As previously mentioned, forest plans generally include the following components: goals and desired conditions, management areas, objectives, suitable uses and activities, standards and guidelines, and monitoring.

Some components differ very little between the action alternatives. The goals and desired conditions are generally the same for the action alternatives, with limited exceptions, which are noted in appendix A. These desired conditions are the result of public involvement and reflect the best available scientific information, including the Interior Columbia Basin Ecosystem Management Project (USDA Forest Service 2000), the Pacific Northwest Region Aquatic and Riparian Conservation Strategy, and more.

The monitoring is an adaptive management tool that will be used to determine if the forest plan is being implemented as intended and if projects implemented using its management direction are moving towards or achieving the goals and desired conditions as expected. Monitoring results will be used to determine if there is a need to change plan components. Many elements of the monitoring plan are the same for all alternatives, but some differences are outlined in appendix A.

## Management Focus

A strategy for the proposed action was developed to guide future development of projects and activities within the national forests. This strategy is included in the other action alternatives. The identification of management focal points highlights those areas where immediate improvements to the resilience of the Blue Mountains ecosystem could be made or areas that are most sensitive from a social perspective. Considering these factors, the drivers for active restoration priorities are:

- Priority watersheds
- Wildland urban interface
- Dry vegetation groups

Areas where multiple drivers overlap are a higher priority than those with only a single driver. Depending on cost sharing or other factors, lower priority work may still occur before higher priority work. This prioritization also recognizes the need for maintenance activities to prevent areas from becoming departed and then needing more expensive restoration treatments.

## Assumptions

Various assumptions were made in the development of the action alternatives that warrant highlighting here.

### Timber and Wildland Fire

- The use of wildland fire as a tool may occur on all acres in all alternatives, with some exceptions described in alternative D, so long as those fires are moving the landscape towards or helping maintain the desired condition.
- The majority of forest vegetation restoration treatments would be scheduled in dry forest groups.
- No even-aged management regeneration harvests would be scheduled within current old forest stands, and only minimal harvest of trees 21 inches d.b.h. or larger or older than 120/150 years would occur.
- All areas that meet the criteria for recommended wilderness areas are identified as unsuitable for timber production. Minimal harvest would occur within these areas, and no new roads would be built.
- No harvest would be scheduled within areas determined to be unsuitable for timber production due to concerns about sensitive soils or difficulty regenerating sites within five years.
- Active timber harvest restoration activities would occur in areas with established road systems (primarily within MA 4A General Forest).
- All fuels generated by management activities would be reduced to meet the desired conditions for down wood.
- Prescribed fire outside of timber harvest units may or may not utilize thinning or piling as a pretreatment depending on anticipated fire effects in relation to the desired conditions.
- The amount of prescribed fire outside of harvest units is constant between alternatives (except alternative D), with the assumption that current levels of prescribed fire are within the current budgetary and organizational capacity of the Forest Service.

- All vegetation treatments (wildland fire and timber harvest) are assumed to have the intent of improving resilience by moving all potential vegetation groups of the potential vegetation groups toward the desired conditions.

# Alternative A: No-action Alternative

The no-action alternative, alternative A, represents a continuation of the 1990 forest plans and their amendments (the current condition). A portion of the Ochoco National Forest is administered by the Malheur National Forest's Emigrant Creek Ranger District using the 1989 forest plan for the Ochoco National Forest and would continue to be administered in that manner. The forest plans placed an emphasis on the production of wood products using even-aged management. These plans include assumptions that ecological conditions were healthy and that disturbances, such as wildland fire and insects and disease, would not substantially affect planned actions, desired outcomes, or outputs. The forest plans provide a mix of natural resource-based goods and services, such as timber and wood products, livestock forage, big game, and minerals in an environmentally sound manner. This alternative reflects the current level of goods and services provided by the unit and the most likely amount of goods and services expected to be provided in the future if current management direction continues (36 CFR 219.12(f)(7), 1982). At the same time, other uses and values, such as scenery, recreational opportunities, viewable wildlife, and clean air and water are provided. The PACFISH, INFISH, and Eastside Screens amendments to the forest plans were intended to provide interim direction but have become long-term management direction.

## Issues to be Resolved

### **Issue 1:** Access

The alternatives address access issues by addressing how the management areas are configured; suitability for summer and winter motor vehicle use and trail construction; and the desired conditions, standards and guidelines. The management areas would remain unchanged in this alternative. There would be no additions to the backcountry areas, no additional wildlife corridors or recommended wilderness areas. Suitable uses for each management area would be those described in the previous 1990 forest plans.

The old forest plans had standards for road density that varied by forest and management areas within the forests. Within the Malheur National Forest, the forestwide open road density standard varies by management area from 1.5 to 3.2 miles per square mile, and off-route motor vehicle travel is authorized unless otherwise restricted.

Within the Umatilla National Forest, the open road density desired condition is 2.0 miles per square mile, and motor vehicle use is limited to designated routes.

Within the Wallowa-Whitman National Forest, the open road density guideline is 2.5 miles per square mile for general forest and 1.5 miles per square mile for summer and winter elk range management area, and off-route motor vehicle travel is authorized unless otherwise restricted.

### **Issue 2:** Economic and Social Well-being

The 1990 forest plans projected robust economic returns to the local communities from management activities, but the returns were realized only during the first few years of implementation because of amendments that addressed habitat needs for listed fish species and other old forest associated ecosystems. These amendments did not adjust the objectives for timber harvest and the allowable sale quantity. The analysis for this alternative updates the allowable sale quantity and objectives for all three national forests using the amended direction and carries the updated figures through the comparison of alternatives and the effects analysis.

Jobs and income are associated with resource flows and uses. The predicted annual timber harvest for the three national forests for alternative A is 81 MMBF. This would support about 577 jobs associated with timber harvest and primary wood products manufacturing and generate about $32.2 million in wages. This would be the second smallest number of jobs projected for the alternatives, and only alternative C would have fewer jobs. Based upon the current number of grazing permits, 242,800 cattle and sheep animal unit months (AUMs) are projected. This would support about 800 jobs and generate about $10.5 million in wages including estimates for unpaid or family labor contributions. Recreation within the three national forests is estimated to be 1.1 million visits annually. Expenditures by the visitors including local residents support about 817 jobs with $16.8 million in wages.

Annual Forest Service budget expenditures including those for ecosystem restoration are projected to be $61.4 million. These dollars would support about 1,221 jobs and $59.2 million in wages. The portion identified as ecosystem restoration expenditures is about $12.7 million, which would support about 224 jobs and generate $7.6 million in wages.

### **Issue 3:** Livestock Grazing and Grazing Land Vegetation

Grazing permit authorizations have diminished since 1990 due to the Federal listing of fish species per the Endangered Species Act and the PACFISH and INFISH amendments to the 1990 forest plans. These changes resulted in stricter management direction for livestock grazing in riparian areas. Within the three national forests, 187,000 acres would be generally suitable for sheep grazing, and 1,889,000 acres would be generally suitable for cattle grazing. These totals are less than what would be generally suitable for alternative D but greater than what would be generally suitable for alternative C. Progress toward achieving desired conditions for rangeland vegetation and livestock grazing would be slow to moderate. The potential for disease transmission from domestic sheep to bighorn sheep would be managed in cooperation with state wildlife agencies, but without revision, the forest plans would lack specific management direction (standards and guidelines) for those cooperative decisions.

### **Issue 4:** Old Forest

Designated old forest management areas are not suitable for timber production per management direction in the 1990 forest plans. The single exception is timber harvest in managed old forest stands within the Umatilla National Forest, but only for the purpose of enhancing wildlife habitat. The 1990 forest plans include standards for snag retention and green tree replacement that provide management direction for retention of some old forest characteristics outside of designated old forest stands. The Eastside Screens forest plan amendment added additional requirements for doing so. As a result, stands with late and old forest structure are managed to retain and develop structure and patch sizes within the historic range of variability, and harvest of trees 21 inches d.b.h. or larger is severely limited.

Alternative A and alternative C are the only alternatives that include designated old forest management areas. Under alternative A, the percentage of old forest structure in all potential vegetation groups within all three national forests would exceed the other alternatives by approximately 1 to 3 percent at year 50. However, the percent of the dry upland forest potential vegetation group in the old forest single story stage within the Malheur and Wallowa-Whitman

National Forests would be less than projected for alternatives D and E, which propose more aggressive forest management strategies.

### **Issue 5:** Recommended Additions to the National Wilderness Preservation System

For alternative A, no areas would be recommended for recommended wilderness. If alternative A is implemented, the allocations of the areas that would be recommended for the action alternatives would remain as they are (existing condition). These allocations vary by national forest.

### **Issue 6:** Ecological Resilience

Improvements to ecological resiliency are mixed, and alternative A has a moderately active approach to managing forest conditions where conflict with other resources is unlikely. The annual forested vegetation active restoration activities, miles of road treatments, and miles of restored riparian areas projected for alternative A would occur at levels similar to those projected for alternatives B and F.

## Other Resources

### Physical Environment

This alternative's proposal for managing riparian conditions is the use of riparian habitat conservation areas. Standards and guidelines for activities within these streams buffers focus on limiting the amount of detrimental change that might occur within riparian habitat conservation areas. Default riparian habitat conservation area widths are 300 feet on each side of fish-bearing streams, 150 feet on each side of perennial non-fish-bearing streams, and 100 feet on each side of intermittent streams.

### Biological Environment

The 1990 forest plans include basic aquatic standards for streams. The plans were amended in 1994 (PACFISH and INFISH) to include direction for the restoration and management of aquatic and riparian areas for native fish species habitat. These amendments established riparian habitat conservation areas and riparian management objectives, which substantially protect threatened or endangered fish species and their habitats by maintaining quality habitat where it exists and reducing risks to habitat and species during the short term. As this short-term strategy became longer-term management direction, passive restoration continued through natural processes. Continuation of this strategy would provide immediate protection to listed fish habitat but would limit long-term management of vegetation within riparian habitat conservation areas. Progress toward achieving desired conditions for riparian vegetation and aquatic habitats would be slow to moderate through passive protections and natural processes. Investments and progress in active restoration for riparian and aquatic habitat improvement, including culvert replacements to improve connectivity of aquatic habitats, would continue at current funding levels.

The alternative A management strategy for big game would continue to be based on habitat effectiveness index and open road density guidelines. Big game security would be provided by travel management plan considerations when designating routes and areas open to motor vehicle travel. Consideration of security areas would be addressed by site-specific project analyses rather than by forest plan desired conditions, objectives, and standards and guidelines.

### Social Environment

Alternative A would keep in place current recommendations for rivers that are eligible or suitable for inclusion in the National Wild and Scenic River System according to analyses completed in response to the 1990 forest plan appeals and their subsequent resolutions.

## Alternative B: The Modified Proposed Action

This alternative is designed to focus on restoring landscapes, their functions, and their processes, and to create resilient landscapes that are adaptable to climate change. Alternative B differs from alternative A by including desired conditions that would emphasize an integrated strategy for managing National Forest System lands. Management allocations would become more consistent between the three national forests. Alternative B would emphasize a combination of active management and natural processes for restoring landscapes.

Substantial public input contributed to the development of the proposed action. Based on a series of public meetings and coordination with various interest groups and tribal, local, state, and Federal governments between 2003 and 2010, several needs for changing the 1990 forest plans were identified. The proposed action was developed to address those needs for change. The proposed action was then distributed for public review in March 2010. Based on public response to the proposed action, the following modifications were incorporated into alternative B:

- Plan components include consideration of possible climate change scenarios where appropriate. Desired conditions for plant species composition and stand density better reflect how this management direction will be used in project planning.
- Acre figures reflect finalized management area boundaries.
- The general suitability table includes fewer activities, but renewable/wind energy development was added.
- The objectives better describe management activities and program outcomes necessary to maintain or achieve desired conditions. The objectives are displayed separately for each national forest.
- Additions, deletions, and modifications to standards and guidelines account for new information and reduce redundancy with existing direction. Direction for domestic sheep grazing addresses bighorn sheep viability concerns regarding disease transmission. The standards and guidelines are displayed by national forest.
- The monitoring section includes more than just those items legally required and management indicator species have been identified.

## Issues

### **Issue 1:** Access

The alternatives address access issues by addressing how the management areas are configured; suitability for summer and winter motor vehicle use and trail construction; and the desired conditions, standards and guidelines. Motor vehicle use during summer and winter, as well as trail construction varies by alternative depending on the management area configuration of the alternative. This alternative designates recommended wilderness area (MA 1B) and it would be suited for over-snow motor vehicle use (table A-40, appendix A). This alternative would also designate both nonmotorized (MA 3A) and motorized (MA 3B) backcountry management areas (table A-40, appendix A). Both summer and winter motor vehicle use would be considered unsuitable in nonmotorized areas (MA 3B). This alternative would not designate any wildlife corridor (MA 3C).

Open motor vehicle route density would change from a standard and/or guideline in alternative A to a desired condition depending on the management area and winter elk habitat. The desired condition for open motor vehicle route density in motorized backcountry management areas would have a desired condition of 1.5 miles per square mile. General Forest (MA 4A) management would have an open route density of 2.4 miles per square mile. Winter elk habitat would have a desired condition of 1.5 miles per square mile. Road maintenance for alternative B would be similar to alternative A.

### **Issue 2:** Economic and Social Well-being

The predicted annual timber harvest for the three national forests for alternative B is approximately 87 MMBF. This harvest level would support about 650 jobs associated with timber harvest and primary wood products manufacturing and generate about $36.2 million in wages, slightly more than projected for alternative A. Alternative B provides slightly less grazing capacity than alternative A with an expected 239,600 cattle and sheep AUMs. This level of AUMs would support about 770 jobs that would generate about $10.2 million in wages including estimates for unpaid or family labor contributions. Recreation within the three national forests is estimated to be at 1.1 million visits annually. Expenditures by the visitors support about 817 jobs with $16.8 million in wages.

Annual Forest Service budget expenditures including those for ecosystem restoration are projected to be $61.4 million. These dollars would support about 1,221 jobs and $59.2 million in wages. The portion identified as ecosystem restoration expenditures is about $12.7 million, which would support about 224 jobs and generate $7.6 million in wages.

### **Issue 3:** Livestock Grazing and Grazing Land Vegetation

Grazing permit authorizations for cattle would remain the same as alternative A, and acres suitable for grazing would also be similar. Permit authorizations for grazing sheep would be slightly reduced to reduce the risk of disease transmission from domestic sheep to bighorn sheep.

### **Issue 4:** Old Forest

This alternative would not include the designation of old forest management areas. The management of old forest would be guided by the desired conditions, such as forested structural stages, stand density, and species composition. Vegetation treatments, both timber harvest and the use of wildland fire, are designed to improve resilience to disturbance while making progress toward a greater abundance of old forest stands. This alternative would include a guideline that would emphasize retaining trees 21 inches d.b.h. and larger, with some exceptions.

Under alternative B, the percentage of old forest structure within all potential vegetation groups in the national forests would be comparable to the other alternatives. However, the percentage of the dry upland forest in the old forest single story stage would be less than projected for alternatives D and E, which propose more aggressive forest management strategies.

### **Issue 5:** Recommended Additions to the National Wilderness Preservation System

Alternative B proposes to recommend 13,400 acres for preliminary administratively recommended additions to the National Wilderness Preservation System. Of the action alternatives, alternative D is the only one with fewer acres (none) proposed. These areas would be closed to summer motor vehicle travel but would remain open to over-the-snow motor vehicles.

### **Issue 6:** Ecological Resilience

For alternative B, the levels of annual forested vegetation active restoration activities proposed to restore ecological resilience would be similar to alternative A. The combination of annual forested vegetation active restoration activities, road treatments, and grazing practices would result in improvements in watershed condition in 4 to 23 subwatersheds.

## Other Resources

### Physical Environment

This alternative proposes to manage riparian conditions through riparian management areas, identified as MA 4B, where they occur within general forest (MA 4A). Desired conditions, standards, and guidelines would provide management direction for these areas. Streamside areas that occur outside of MA 4A would be subject to the same desired conditions and standards and guidelines as MA 4B. The riparian management area width would be either 300 feet (slope distance) on each side of fish-bearing streams or the outer edge of the 100-year floodplain, whichever is greater. For perennial non-fish-bearing streams, the width would be either 150 feet (slope distance) on each side of the stream or the outer edge of the 100-year floodplain, whichever is greater. For intermittent and ephemeral streams, the width would be 100 feet (slope distance) on each side. These riparian management area criteria are the same as those used for riparian habitat conservation areas in key and priority watersheds for PACFISH and INFISH but would apply throughout the planning area.

### Biological Environment

Habitats for fish species with management concerns (at-risk species) would be managed consistent with the Pacific Northwest Region Aquatic Restoration and Conservation Strategy.

### Social Environment

All streams considered by the Forest Service to be eligible for inclusion in the National Wild and Scenic River System would be allocated to wild and scenic river management areas (MA 2A). These river corridors would be managed to avoid compromising potential outstandingly remarkable values.

# Alternative C

Alternative C varies from alternative B by emphasizing the role of natural processes in forest restoration (also referred to as passive restoration). When compared to the other alternatives, less timber would be harvested, more area would be allocated for nonmotorized recreation, and more area would be allocated to recommended wilderness areas. Similar to alternative A, old forest would be mapped and allocated to a management area. The harvest of large trees (21 inches d.b.h. or larger) would be prohibited with no exceptions. Managed wildland fire for resource benefit would be highest in this alternative to achieve the desired condition. Wildlife corridor management areas would be mapped and allocated to management area. This alternative would make substantial reductions to the permitted number of domestic livestock. The default width of riparian management areas would be greater than what is proposed for the other alternatives.

## Issues

### **Issue 1:** Access

The alternatives address access issues by addressing how the management areas are configured; suitability for summer and winter motor vehicle use and trail construction; and the desired conditions, standards and guidelines. Nonmotorized uses would be emphasized in this alternative. Wildlife Corridor (MA 3C) is proposed, as are backcountry nonmotorized (MA 3A) and recommended wilderness areas (MA 1B). No National Forest System lands would be designated as motorized backcountry (MA 3B).

This alternative designates the most recommended wilderness area (MA 1B), which would not be suited for over snow motor vehicle use (Tables A-45, appendix A).

The desired condition for open motor vehicle route density within watersheds in MA 3C is 1 mile per square mile or less. In addition, all cross-country over-the-snow vehicle travel is prohibited, with over-the-snow vehicle travel permitted only on routes designated open to summer motor vehicle travel in MA 3C. Alternative C would provide the least amount of area considered generally suitable for motor vehicle use in summer and in winter.

The desired condition for open motor vehicle route density within watersheds in General Forest (MA 4A) is 2.4 miles per square mile or less. Within subwatersheds, an exception is made for winter elk habitat, where the open motor vehicle route density is 1.5 miles per square mile or less.

Road maintenance projections are also the lowest, primarily because fewer roads would be open for motor vehicle use and therefore less maintenance would be needed.

### **Issue 2:** Economic and Social Well-being

The predicted annual timber harvest for the three national forests for alternative C is approximately 47 MMBF, the smallest projection among all of the alternatives. This would support about 288 jobs associated with timber harvest and primary wood products manufacturing and generate about $16.0 million in wages. Domestic livestock grazing would be reduced to 95,900 AUMs, which would support about 308 jobs and generate about $4.1 million in wages including estimates for unpaid or family labor contributions. Recreation within the three national forests is estimated at 1.1 million visits annually. Expenditures by the visitors support about 817 jobs with $16.8 million in wages.

Annual Forest Service budget expenditures including those for ecosystem restoration are projected to be $55.7 million. These dollars would support about 1,130 jobs and $55.3 million in wages. The portion identified as ecosystem restoration expenditures is about $8.1 million, which would support about 142 jobs and generate $4.9 million in wages.

### **Issue 3:** Livestock Grazing and Grazing Land Vegetation

The area that would be generally suitable for cattle grazing would be reduced to approximately 785,000 acres, the smallest projection among alternatives. This decrease would result from the classification of riparian areas and subwatersheds with habitat for listed fish species as generally unsuitable for cattle grazing.

The area that would be generally suitable for sheep grazing would be reduced to approximately 90,000 acres, also the lowest projection among alternatives. This decrease would result from the classification of subwatersheds within the maximum foray distance for bighorn sheep rams as generally unsuitable for sheep grazing.

### **Issue 4:** Old Forest

Old forest (390,900 acres) would be allocated to MA 4C Old Forest. Only trees 8 inches d.b.h. or less would be authorized for timber harvest in this management area. This alternative would include a standard that would strictly prohibit the harvesting of trees 21 inches d.b.h. and larger, both within and outside of old forest.

This alternative would include a standard that would strictly prohibit the harvesting of trees 21 inches d.b.h. and larger, both within and outside of old forest.

Under alternative C, the percentage of old forest structure within all potential vegetation groups in the national forests would be comparable to the other alternatives. However, the percentage of the dry upland forest in the old forest single story stage would be lower than projected for all other alternatives due to less aggressive forest management strategies.

### **Issue 5:** Recommended Additions to the National Wilderness Preservation System

Approximately 505,000 acres would be recommended wilderness or allocation to MA 1B, the largest projection of the alternatives, comprised of the potential wilderness areas. This area would be closed to both summer and winter motor vehicle use, but mechanized travel would be permitted (e.g., bicycles and hunting carts). Mechanized uses would be prohibited if these areas become designated wilderness areas.

### **Issue 6:** Ecological Resilience

Alternative C is designed to emphasize the role of natural processes in the restoration of ecological resilience. Forested vegetation mechanical restoration treatments and forage use intensity both would be less than all the other alternatives. With the exception of alternative D, roads treatments would be greater than the other alternatives. The greatest amount of subwatersheds would be improved, but the dry forest fire regime condition class departure score would improve the least.

## Other Resources

### Physical Environment

Similar to alternative B, the riparian management areas in general forest would be allocated to MA 4B; however, the riparian management areas would be 300 feet (slope distance) on each side of any stream, regardless of classification. Alternative C would greatly restrict livestock grazing within riparian areas. Many of the riparian management area desired conditions are the same as alternative B, but there are some additional standards and guidelines and some of the guidelines go to standards.

### Biological Environment

Habitats for fish species with management concerns (at-risk species) would be managed consistent with the Pacific Northwest Region Aquatic Restoration and Conservation Strategy.

Approximately 502,200 acres would be allocated to Wildlife Corridor (MA 3C) (this management area allocation is unique to alternatives C, E, and F). The desired condition for open motor vehicle route density within watersheds in MA 3C is 1 mile per square mile or less. As previously mentioned in Access, all cross-country over-the-snow vehicle travel is prohibited, with over-the-snow vehicle travel permitted only on routes designated open to summer motor vehicle travel in MA 3C providing additional security to wildlife from motor vehicle use.

Desired conditions describe the desired forest densities and limits would be placed on canopy cover reduction.

### Social Environment

As with alternative B, all streams considered eligible for inclusion in the National Wild and Scenic River System by the Forest Service would be allocated to MA 2A. These river corridors would be managed to avoid compromising potential outstandingly remarkable values.

# Alternative D

This alternative would include more timber harvest than all other alternatives and would emphasize active management using mechanical treatments to restore the forested landscape. This alternative also responds to requests for more public motor vehicle access. No areas would be allocated to recommended wilderness area or allocation to MA 1B. This alternative does not include a standard or guideline prohibiting the harvest of trees 21 inches d.b.h. or larger, but relies exclusively on desired conditions. This alternative proposes the smallest riparian management area.

## Issues

### **Issue 1:** Access

The alternatives address access issues by addressing how the management areas are configured; suitability for summer and winter motor vehicle use and trail construction; and the desired conditions, standards and guidelines. This alternative does not designate any Wildlife Corridor (MA 3C), backcountry nonmotorized (MA 3A) or recommended wilderness areas (MA 1B). This alternative designates backcountry motorized (MA 3B), which are suitable for both summer and winter motor vehicle use.

The desired condition for open motor vehicle route density within watersheds in General Forest (MA 4A) is 3 miles per square mile or less. Within subwatersheds, an exception is made for winter elk habitat, where the open motor vehicle route density is 1.5 miles per square mile or less.

This alternative emphasizes retaining the areas that currently are generally suitable for motor vehicle use, resulting in more area suitable for summer and winter motor vehicle use than proposed by the other alternatives.

Road maintenance projections are also the highest, primarily because more roads would be open for motor vehicle use and would be maintained.

### **Issue 2:** Economic and Social Well-being

The predicted annual timber harvest for the three national forests for alternative D is approximately 243 MMBF. This would support about 2,040 jobs associated with timber harvest and primary wood products manufacturing and generate about $113.7 million in wages, the largest projection for the alternatives. The estimated 244,600 cattle and sheep AUMs are slightly more than alternative A. Domestic livestock grazing would support about 833 jobs and generate about $11.1 million in wages including estimates for unpaid or family labor contributions. Recreation within the three national forests is estimated at 1.1 million visits annually. Expenditures by the visitors support about 817 jobs with $16.8 million in wages.

Annual Forest Service budget expenditures including those for ecosystem restoration are projected to be $74.5 million. These dollars would support about 1,444 jobs and $68.7 million in wages. The portion identified as ecosystem restoration expenditures is about $24.0 million, which would support about 424 jobs and generate $14.3 million in wages.

### **Issue 3:** Livestock Grazing and Grazing Land Vegetation

Grazing permit authorizations for cattle would be slightly higher than the other action alternatives. Both active and inactive allotments are included in this alternative, unlike alternative B, E and F, which only include active allotments. Permit authorizations for grazing sheep would be slightly reduced to reduce the risk of disease transmission from domestic sheep to bighorn sheep. Alternative D would use desired conditions to address livestock grazing and rangeland vegetation rather than the standards and guidelines proposed for all other alternatives.

### **Issue 4:** Old Forest

This alternative would not include the designation of old forest management areas, similar to alternatives B, E, and F. The management of old forest would be exclusively guided by the desired conditions, such as forested structural stages, stand density, and species composition without additional old tree standards or guidelines. Vegetation treatments are designed to improve resilience to disturbance while making progress toward a greater abundance of old forest stands this alternative does not include a designated old forest management area.

Under alternative D, the percent of the landscape in old forest structural stages in all potential vegetation groups would vary from the other alternatives by approximately one to three percent at year 50. Within the dry upland forest potential vegetation groups, the percent in the old forest single story stage would be highest under alternatives D and E. This would be due to increased timber harvest resulting in more open stand densities and increased growth of the residual trees, creating more larger-diameter trees. Vegetation treatments would emphasize mechanical treatments rather than wildland fire use (planned or unplanned ignitions).

### **Issue 5:** Recommended Additions to the National Wilderness Preservation System

Alternative D is the only action alternative that would not recommend any area for preliminary administratively recommended wilderness or allocations to MA 1B.

### **Issue 6:** Ecological Resilience

Alternative D is designed to have the most aggressive approach to restoring the ecological resilience of forested vegetation and thus would have the most forested vegetation mechanical restoration treatments. As a result of road maintenance associated with timber sales, road treatments (miles) would be the greatest of the alternatives. Forage use intensity would be slightly greater than the projection for alternative B. The dry forest fire regime condition class departure score would improve the most, but, due to forage use intensity, alternative D would have the least number of improved subwatersheds. However, alternative D would not include prescribed burning (planned ignitions) outside of harvest units and would include very limited amounts of prescribed burning (planned ignitions) within harvest units. Under alternative D, the majority of fuels treatments within harvest units would be accomplished by removal or crushing instead of burning. There would be no objective for managed wildland fire for resource benefits in this alternative.

### Other Resources

#### Physical Environment

The approach to management of riparian conditions would be similar to alternative B in that riparian management areas (MA 4B ) would be designated where they occur within general forest (MA 4A). Desired conditions and standards and guidelines for riparian management areas are also the same. Alternative D differs from alternative B by proposing to narrow riparian management areas. The widths would be similar to the State of Oregon Forest Practices Act as described in the November 15, 2007 Oregon Administrative Rules (OAR 629-635-0000). For fish-bearing streams, the riparian management area would be 100 feet (slope distance) on either side of the stream or the outer edge of the 100-year floodplain, whichever is greatest. For perennial non-fish-bearing streams, the width would be 70 feet (slope distance) or the outer edge of the 100-year floodplain. For intermittent and ephemeral streams, the width would be 50 feet (slope distance) on each side, whichever is greatest.

#### Biological Environment

Habitats for fish species with management concerns (at-risk species) would be managed consistent with the Pacific Northwest Region Aquatic Restoration and Conservation Strategy, with the exception of establishing riparian management area widths that are narrower than the Strategy's expectations for functional riparian management area widths.

#### Social Environment

All streams within the Malheur and Umatilla National Forests considered by the Forest Service to be eligible for inclusion in the National Wild and Scenic River System would be allocated to wild and scenic river management areas (MA 2A). These river corridors would be managed to avoid compromising potential outstandingly remarkable values.

Past suitability studies for 11 rivers within the Wallowa-Whitman National Forest concluded that three rivers are suitable for inclusion in the system. These conclusions would be accepted, and, as a result, fewer river corridors than for alternative B would be allocated to wild and scenic river management areas (MA 2A), where management would avoid compromising potential outstandingly remarkable values.

## Alternative E

Alternative E would use vegetation management, aquatic and wildlife habitat treatments to emphasize active restoration. The alternative responds to public concerns and questions (as captured in issue 6) about the environmental effects of accelerating efforts to restore ecological resilience beyond recent levels. While similar to alternative B in many regards, alternative E would increase restoration projects occurring within the national forests, resulting in almost twice as much area being restored through vegetation management activities.

This alternative focuses on the desired condition to reduce hydrologic connectivity as opposed to using road density, so that roads contributing the most sediment to the aquatic and riparian system will be addressed, focusing on threatened and endangered fish species habitat. Both riparian and aquatic habitat improvement activities and road maintenance proposals for investments in aquatic restoration within key and priority watersheds are significantly greater than alternative B proposes.

Objectives for rangeland vegetation restoration and management of wildfire to achieve desired conditions would be greater than those for alternative B.

Alternative E would include more recommended wilderness areas (MA 1B) than alternative B but significantly less than alternative C.

This alternative would eliminate the old tree guideline based on diameter and replace it with a guideline that would emphasize retaining trees with certain old tree characteristics in order to protect old trees.

## Issues

### **Issue 1:** Access

The alternatives address access issues by addressing how the management areas are configured; suitability for summer and winter motor vehicle use and trail construction; and the desired conditions, standards and guidelines. The approach to managing access would be similar to alternative B, with a few exceptions. This alternative identifies recommended wilderness areas (MA 1B), which would allow for the use of over-the-snow motor vehicle use in winter (table A-47, appendix A). It also, designates a small amount of wildlife corridor (MA 3C), linking high quality, unroaded wildlife habitats which would allow the suitable use of motor vehicle use in summer and winter on designated routes. This alternative would also designate both nonmotorized (MA 3A) and motorized (MA 3B) backcountry management areas. Both summer and winter motor vehicle use would be considered unsuitable in nonmotorized areas (MA 3B).

Open motor vehicle route density would change from a standard and/or guideline in alternative A to a desired condition depending on the management area and winter elk habitat. The desired condition for open motor vehicle route density in motorized backcountry management areas (MA 3B) would be to minimize the number of miles of designated routes. The open motor vehicle route density in MA 3C would be no greater than 1 mile per square mile. Winter elk habitat would have a desired condition of 1.5 miles per square mile. The desired condition for this alternative is to reduce the road related sedimentation by reducing road density and reducing the hydrologic connectivity of the road system. Road maintenance for alternative E would be similar to alternative A.

This alternative takes a different approach by moving away from road densities in general forest (MA 4A) and instead focusing on the roads that are causing the biggest problems on the landscape to fish and aquatic ecosystems. In this alternative, the desired condition would focus on hydrologically disconnecting the roadbed from the stream system. This would involve replacing undersized culverts, out-sloping roads, hardening surfaces to reduce erosion, occasionally relocating or decommissioning roads to address the roads with a focus on watersheds with threatened and/or endangered aquatic fish species.

### **Issue 2:** Economic and Social Well-being

The predicted annual timber harvest for the three national forests for alternative E is approximately 162 MMBF, more than projected for alternative A but less than projected for alternative D. This level of harvest would support about 1,330 jobs associated with timber harvest and primary wood products manufacturing and generate about $74.3 million in wages. The projected 239,800 cattle and sheep AUMs are similar to projections for alternative B, and would support about 780 jobs and generate about $10.3 million in wages including estimates for unpaid or family labor contributions. Recreation within the three national forests is estimated at 1.1 million visits annually. Expenditures by the visitors support about 817 jobs with $16.8 million in wages.

Annual Forest Service budget expenditures including those for ecosystem restoration are projected to be $65.8 million. These dollars would support about 1,290 jobs and $62.1 million in wages. The portion identified as ecosystem restoration expenditures is about $16.2 million, which would support about 285 jobs and generate $9.7 million in wages.

### **Issue 3:** Livestock Grazing and Grazing Land Vegetation

Proposals made for alternative B would be retained with the following exceptions. An objective designed to improve a portion of rangeland in phase C or D to phase A or B would be included. Utilization guidelines would place additional limitations on livestock grazing in subwatersheds with occupied bull trout spawning and rearing reaches and habitat for listed anadromous fish species. The management approach proposed to reduce the risk of disease transmission from domestic sheep to bighorn sheep for alternative D would also be proposed in alternative E.

### **Issue 4:** Old Forest

Vegetation treatments, both timber harvest and the use of wildland fire, are designed to improve resilience to disturbance while making progress toward a greater abundance of old forest stands. This alternative would not include the designation of old forest management areas, similar to alternatives B, D and F. The management of old forest would be guided by the desired conditions, such as forested structural stages, stand density, and species composition with additional old tree guidelines. This alternative would include a guideline that emphasizes retaining trees with certain old tree characteristics, both within and outside of old forest stands. For most tree species, certain tree characteristics can be used as a fairly reliable indicator of older age (generally greater than 150 years old, but varies by species and site).

Under alternative E, the percent of the landscape in old forest structural stages in all potential vegetation groups would vary from the other alternatives by approximately one to three percent at year 50. Within the dry upland forest potential vegetation groups, the percent in the old forest single-story stage would be highest under alternatives D and E. This would be due to increased timber harvest resulting in more open stand densities and increased growth of the residual trees, creating more larger-diameter trees. Vegetation treatments would emphasize mechanical treatments and wildland fire use (planned and unplanned ignitions).

### **Issue 5:** Recommended Additions to the National Wilderness Preservation System

At approximately 90,800 acres, the area that would be allocated to MA 1B (preliminary administratively recommended wilderness areas) is greater than the area that would be allocated for alternative B but significantly less than alternative C.

### **Issue 6:** Ecological Resilience

For alternative E, forested vegetation mechanical restoration treatments would be second to alternative D. Road treatments (miles), improved riparian areas (miles), and forage use intensity would all be higher than alternative B. The number of subwatersheds that would be improved is slightly more than the alternative B projection but less than alternative C. The improvement in the dry forest fire regime condition class departure score would be similar to alternative D but more than projected for the other alternatives. Because alternative E would add the reintroduction of fire to the ecosystem in addition to the decreased fire regime condition class departure score, this alternative would be expected to result in increased ecological resiliency in the dry upland forest potential vegetation groups because fuel composition, fire frequency, severity, pattern, and other associated disturbances would more closely resemble the historic range of variability.

### Other Resources

#### Physical Environment

This alternative's proposal for managing riparian conditions is the use of riparian management areas with the same desired conditions, standards and guidelines, and riparian management area widths proposed for alternative B.

#### Biological Environment

Habitats for fish species with management concerns (at-risk species) would be managed consistent with the Pacific Northwest Region Aquatic Restoration and Conservation Strategy. Protection for fisheries would be stronger than alternative B with the additions of stricter livestock grazing utilization guidelines for watersheds with occupied bull trout spawning and rearing reaches and habitat for listed anadromous fish species. Fisheries would also benefit from road maintenance projections that are greater than the projections for alternative B. In addition, approximately 28,100 acres would be allocated to MA 3C Wildlife Corridor, and these corridors would connect large blocks of undeveloped habitat within the Umatilla and Wallowa-Whitman National Forests. Over-the-snow motor vehicle use would be allowed only on designated routes in MA 3C. No acres would be allocated to MA 3C within the Malheur National Forest.

#### Social Environment

Alternative E makes the same proposals for management of wild and scenic rivers as alternative D.

## Alternative F

The management emphasis is essentially the same as stated for alternative E. Management activities for active restoration, while greater than proposals made for alternative B, would be less than the proposals for alternative E. The investment in vegetation treatments would be the same as proposed for alternative B. Alternative F proposes the same desired conditions and management areas as alternative B and E.

Both riparian and aquatic habitat improvement activities and road maintenance proposals for investments in aquatic restoration within key and priority watersheds are significantly greater than the alternative B proposals.

Objectives for rangeland vegetation restoration and management of wildfire to achieve desired conditions would be greater than those for alternative B.

Alternative F would include the same number of acres of recommended wilderness areas (MA 1B) as alternative E, more than alternative B but significantly less than alternative C.

This alternative would eliminate the old tree guideline based on diameter and replace it with an age-based guideline to guide the protection of old trees.

## Issues

### **Issue 1:** Access

The same proposals made for alternative E are made for alternative F.

### **Issue 2:** Economic and Social Well-being

The predicted annual timber harvest for the three national forests for alternative F is approximately 107 MMBF. This would support about 838 jobs associated with timber harvest and primary wood products manufacturing and generate about $46.3million in wages, more than projected for alternative B but less than projected for alternative E. The projected 239,800 cattle and sheep AUMs would support about 774 jobs that would generate about $10.3 million in wages including estimates for unpaid or family labor contributions. Recreation within the three national forests is estimated at 1.1 million visits annually. Expenditures by the visitors support about 817 jobs with $16.8 million in wages.

Annual Forest Service budget expenditures including those for ecosystem restoration are projected to be $60.2 million. These dollars would support about 1,201 jobs and $58.3 million in wages. The portion identified as ecosystem restoration expenditures is about $11.7 million, which would support about 206 jobs and generate $7.0 million in wages.

### **Issue 3:** Livestock Grazing and Grazing Land Vegetation

The same proposals made for alternative E are made for alternative F.

### **Issue 4:** Old Forest

This alternative would not include the designation of old forest management areas. As with all of the action alternatives, the management of old forest would be guided by the desired conditions, such as forested structural stages, stand density, and species composition with the addition of a guideline stating that management of individual, large diameter and/or old trees would emphasize retaining trees greater than 150 years old. Vegetation treatments, both timber harvest and the use of wildland fire, are designed to improve resilience to disturbance while making progress toward a greater abundance of old forest stands.

Under alternative F, the percent of the landscape in old forest structural stages in all potential vegetation groups would vary from the other alternatives by approximately one to three percent at year 50. Within the dry upland forest potential vegetation group, the percent in the old forest single story stage would be lower, compared to alternatives D and E. This would be due to lower levels of timber harvest resulting in less open stand densities and decreased growth of the residual trees.

### **Issue 5:** Recommended Additions to the National Wilderness Preservation System

The same proposals made for alternative E are made for alternative F.

### **Issue 6:** Ecological Resilience

Forested vegetation mechanical restoration treatments would be more than projected for alternative B but less than for alternative E. Road treatments (miles) would be slightly less than projected for alternative E. The improvement in the dry forest fire regime condition class departure score would be greater than alternatives A, B, and C but less than alternatives D and E.

### Other Resources

#### Physical Environment

This alternative's approach to management of riparian conditions is to implement riparian management areas, using the same desired conditions, standards, and guidelines and defining the same streams widths as alternatives B and E.

#### Biological Environment

The management approach to habitats for fish species with management concerns (at-risk species) and allocating areas to wildlife corridors is the same as proposed for alternative E. The maximum utilization within riparian management areas would provide greater protection to anadromous fish by imposing slightly more restrictive grazing standards in riparian areas.

#### Social Environment

Alternative F makes the same proposals for management of wild and scenic rivers as alternatives D and E.

# Description of Alternatives Considered but Eliminated from Detailed Study

During the scoping period, the Blue Mountains forest plan revision team received a large number of comments on the proposed action. Many of those comments included specific requests for changes in management area allocations, goals and objectives, standards and guidelines, and monitoring requirements. Given the large area under consideration and the number of decisions being made, there are a large number of possibilities for combining different alternative components. Various components from these comments were incorporated into the alternatives studied in detail, but some requests were not carried forward because they closely resemble alternatives considered in detail, did not meet the purpose and need for forest plan revision, or were not appropriate for a forest plan decision.

## Alternative G – Minimum Management Alternative

Some people desire an alternative that eliminates human uses and human induced impacts to the Blue Mountains national forests. In this alternative, there would be no vegetation management, no wildlife habitat improvements, no grazing permits, limited recreation use, and limited access to the national forests. This alternative was considered but not studied in detail because this level of management is already described in the Minimum Management Level Benchmark (available in the project record). This alternative does not address all the identified issues and it would eliminate most of the multiple uses and benefits for which the national forests were created. With demonstrated demands for public access, recreation experiences, and forest products, elimination of these activities would conflict with current agency policy. Alternative C, which would substantially reduce the amount of human uses and activities, addresses these comments.

## Alternative H – Elimination of Inventoried Roadless Areas

Some people desire an alternative that would release the areas in the inventoried roadless areas into general forest and make them suitable for timber production and road building. Inventoried roadless areas were evaluated and considered for recommendation as potential wilderness areas in accordance with 36 CFR 219.17. The results of the evaluation were considered during the analysis of the alternatives studied in detail and are disclosed in chapter 3 and appendix F. Inventoried roadless areas within all three national forests are allocated to management areas where their undeveloped character will be retained by restricting road construction and timber harvest. Additionally, in 2012, the Supreme Court retained the 2001 Roadless Area Conservation Rule which prohibits road construction, road reconstruction, and timber harvesting in inventoried roadless areas on National Forest System lands, with some exceptions (36 CFR 294, Subpart B). This ruling means that areas designated as inventoried roadless areas would retain certain protections regardless of what management area they fall under. For a full disclosure of the inventoried roadless areas and the management areas they fall under see the Recommended Wilderness Area Section in chapter 3.

## Alternative I – No Commercial Timber Harvest

A number of individuals and organizations asked for consideration of an alternative that would include no commercial timber harvest. Some of these comments suggested that vegetation treatments to meet habitat objectives would be acceptable to them, but commercial timber sales would not be. The National Forest Management Act of 1976 allows for the commercial harvest of timber from National Forest System lands for the purpose of achieving the policies set forth in the Multiple-Use Sustained-Yield Act of 1960. The no-harvest proposal is addressed to some degree in all of the alternatives considered in detail, and alternative C addresses this concern more than the other alternatives by projecting a relatively low amount of commercial timber harvest. These alternatives include management area allocations where there would be no commercial timber harvest. These allocations include wilderness areas, proposals to recommend the designation of wilderness areas, and many of the special areas.

## Alternative J – No Grazing Alternative

Among the comments were requests for analysis of an alternative that prohibits grazing. While the National Forest Management Act requires the Forest Service to address rangeland capability and suitability, stocking decisions for specific grazing allotments are made through site-specific NEPA analyses. Grazing is authorized by term grazing permits. The forest plans define the desired outcomes and prescriptive measures (i.e., standards and guidelines that may influence grazing practices allowed by term grazing permits), but do not make decisions for livestock grazing use or capacity levels. The restrictions on grazing proposed for alternative C, while not stating that grazing would be prohibited, would severely limit the amount of domestic livestock grazing within the Blue Mountains national forests.

## Alternative K – Unconstrained Budget Alternative

An alternative that assumes an unconstrained future budget was suggested. An unconstrained budget is inherently unrealistic and unreasonable. In addition, a forest plan does not influence or control the budget for a national forest. This alternative was eliminated from further study. Alternatives D, E, and F include budget assumptions that would exceed the current budget.

## Alternative L – No Wildfire Use Alternative

Comments received suggested the Forest Service should consider an alternative that eliminates wildland fire use. The Forest Service national policy is to manage naturally ignited wildland fires to meet land management direction specified in the forest plan. Use of wildland fire allows the Forest Service to explicitly acknowledge when and where a naturally ignited wildland fire could create, enhance, or maintain desired conditions. As always, the overriding consideration in any response to a wildland fire remains firefighter and public safety. Many scientific studies have concluded that restoration of wildland fire as an ecological process is essential to land health. Therefore, this alternative was not analyzed in detail. There would be no objective for managed wildland fire for resource benefits in alternative D.

## Alternative M – Site-specific Travel Management Alternative

Some public comments requested that individual routes (roads and trails) or all unclassified routes be evaluated and decisions be made concerning their designation and use through the revision process. A review of routes requires more site-specific analysis and more alternatives than would be practical during forest plan revision. A forest plan is strategic, making decisions concerning desired conditions, goals and objectives, standards and guidelines, and suitable uses. Access has been identified as a significant issue and will be analyzed and discussed in this DEIS, but analysis to open or close specific routes or areas to motor vehicle access is site-specific and is not within the scope of the forest plan revision.

## Alternative N – Other Management Indicator Species Alternative

The public requested that many species be considered as management indicator species. The purpose of management indicator species is to show effects of management actions. The designation does not infer a special degree of protection. Species selected as management indicator species can be monitored and a connection between habitat and management activities can be made. This connection cannot be made with most of the species suggested by the public and even most of those identified in the 1990 forest plans. The analysis of the current management indicator species is included in the analysis and description of alternative A (no action). The complete list of species considered and the rationale for those selected and not selected is available in the project record. The Aquatic and Terrestrial Wildlife Species Diversity and Viability Sections discuss the management indicator and focal species identified for this planning effort and the predicted effects from each alternative.

## Alternative O – No Herbicide Use Alternative

Some public comments asked that an alternative that eliminates the use of herbicides to contain, control, or eradicate invasive species be analyzed. Herbicides, along with prevention and manual control methods, are part of the range of tools available to contain, control or eradicate invasive species. Site-specific analyses, including risk assessments of any herbicides proposed for use, will determine the best method or combination of methods that should be used to safely and effectively manage invasive species in the Blue Mountains national forests. All alternatives incorporate the decisions for management of invasive species outlined in the Forest Service Pacific Northwest Region Preventing and Managing Invasive Plants Final Environmental Impact Statement and Record of Decision (USDA Forest Service 2005).

## Alternative P – Wilderness Area Emphasis Alternative

Some individuals and groups requested an alternative that allocates all unroaded areas on the Blue Mountains national forests greater than 1,000 acres to recommended wilderness areas. Many of these areas did not meet the Forest Service Handbook (FSH 1909.12 chapter 70) criteria for inclusion in the inventory of areas with wilderness area potential. Alternative C, would allocate more than 500,000 acres to recommended wilderness areas, responds to the request to emphasize wilderness areas.

## Alternative Q – Conformance with the Resource Planning Act Alternative

NFMA regulations require development of at least one alternative that incorporates the Resource Planning Act (RPA) Program's tentative objectives for each national forest as displayed in Regional Guides (36 CFR 219.12(f)(6). The last RPA program was developed in 1995. Regional guides were eliminated in the 2000 Planning Rule (36 CFR 219.35) The Forest Service Strategic Plan for 2007-12, in lieu of an RPA program, was completed in accordance with the Government Performance Results Act (GPRA) and the Interior and Related Agencies Appropriations Act. The strategic plan does not recommend outputs to incorporate in specific forest plans, but all alternatives analyzed in detail incorporate the broad strategic objectives.

# Comparison of Alternatives

This section compares how the alternatives are different for each national forest with respect to the issues to be resolved and their key indicators and management areas.

## Issues to be Resolved

Tables 1, 2, and 3 display the comparison of how the alternatives respond to the issues to be resolved and the key indicators identified in chapter 1 for each national forest based on the objectives identified for each alternative. The figures displayed for alternative A represent the existing condition. See appendix A for a detailed description of the alternatives, including the objectives.

**Table 1. Key indicators for each alternative for the Malheur National Forest**

| Key Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| **Issue 1: Access (Malheur NF)** | | | | | | |
| Miles of road maintained annually | 1,152 | 1,136 | 235 | 1,604 | 1,313 | 1,313 |
| Percent change in area available for route designation for summer motor vehicle use | 0% | 7% | minus-38% | 11% | 8% | 8% |
| Percent change in area available for winter over-the-snow vehicle use | 0% | negligible | minus-28% | 2% | minus-1% | minus-1% |
| **Issue 2: Economic and social well-being (Malheur NF)** | | | | | | |
| Timber harvest jobs | 133 | 142 | 67 | 418 | 263 | 170 |
| Timber harvest income | $7.214M | $7,674M | $3,625M | $22,660M | $14,224M | $9,238M |
| Livestock grazing jobs | 389 | 398 | 187 | 439 | 395 | 389 |
| Livestock grazing income | $5,195M | $5,316M | $2,550M | $5,881M | $5,276M | $5,195M |
| Recreation jobs | 233 | 233 | 233 | 233 | 233 | 233 |
| Recreation income | $4,589M | $4,589M | $4,589M | $4,589M | $4,589M | $4,589M |
| Ecosystem restoration jobs | 68 | 68 | 41 | 125 | 85 | 62 |
| Ecosystem restoration income | $2,066M | $2,066M | $1,252M | $3,790M | $2,575M | $1,867M |
| Predicted harvest levels/TSPQ (MMBF/year) | 30 | 31 | 16 | 87 | 56 | 37 |
| Allowable sale quantity (MMBF/year) | 55 | 55 | 34 | 88 | 55 | 55 |
| **Issue 3: Livestock grazing and grazing land vegetation (Malheur NF)** | | | | | | |
| Acres suitable for permitted cattle grazing | 1,197,000 | 1,225,000 | 620,000 | 1,216,000 | 1,197,000 | 1,197,000 |
| Acres suitable for permitted sheep grazing | 102,000 | 101,000 | 55,000 | 101,000 | 101,000 | 101,000 |
| Permitted animal unit months (cattle) | 117,000 | 120,000 | 61,000 | 119,000 | 117,000 | 117,000 |
| Permitted animal unit months (sheep) | 6,500 | 6,500 | 1,200 | 6,500 | 6,500 | 6,500 |
| Rate of progress towards achieving rangeland vegetation desired condition | slow to moderate | slow to moderate | fastest | slow | moderate to fastest | moderate to fastest |

**Table 1. Key indicators for each alternative for the Malheur National Forest**

| Key Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| **Issue 4: Old Forest (Malheur NF)** | | | | | | |
| Acres of old forest within management area allocations with limited management activity | 78,000 | 81,000 | 350,000 | 73,000 | 85,000 | 85,000 |
| Acres of vegetation treatments per year in old forest | 500 | 800 | 0 | 4,800 | 1,600 | 1,000 |
| Percent old forest at year 50 (all potential vegetation groups) | 33 | 31 | 31 | 30 | 30 | 30 |
| Percent dry upland forest old forest single story at year 50 | 13 | 11 | 10 | 16 | 16 | 12 |
| **Issue 5: Preliminary Administratively Recommended Additions to the National Wilderness Preservation System (Malheur NF)** | | | | | | |
| Acres of MA 1B | 0 | 1,200 | 83,800 | 0 | 30,400 | 30,400 |
| **Issue 6: Ecological Resilience (Malheur NF)** | | | | | | |
| Annual forested vegetation active restoration activities (acres) | 18,100 | 18,700 | 14,300 | 25,100 | 24,800 | 20,100 |
| Miles of road treatments | 260 | 260 | 600 | 650 | 290 | 310 |
| Percent forage use intensity | 15.9 | 15.9 | 3.8 | 17.0 | 15.9 | 15.9 |
| Miles of riparian area improvement | 300 | 300 | 600 | 300 | 450 | 400 |
| Number of subwatersheds in improved condition | 16 | 16 | 42 | 18 | 21 | 21 |
| Improvement in the dry upland forest potential vegetation groups fire regime condition class departure score at year 50 (percent) | 24 | 27 | 23 | 47 | 42 | 31 |

**Table 2. Key indicators for each alternative for the Umatilla National Forest**

| Key Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| **Issue 1: Access (Umatilla NF)** | | | | | | |
| Miles of road maintained annually | 427 | 427 | 209 | 910 | 540 | 540 |
| Percent change in area available for route designation for summer motor vehicle use | 0% | 7% | minus-45% | 9% | minus-5% | minus-5% |
| Percent change in area available for winter over-the-snow vehicle use | 0% | negligible | minus-30% | 2% | minus-4% | minus-4% |
| **Issue 2: Economic and social well-being (Umatilla NF)** | | | | | | |
| Timber harvest jobs | 243 | 263 | 117 | 777 | 561 | 339 |
| Timber harvest income | $13,882M | $15,006M | $6,707M | $44,365M | $32,058M | $19,388M |
| Livestock grazing jobs | 153 | 130 | 19 | 127 | 127 | 127 |
| Livestock grazing income | $1,874M | $1,674M | $219M | $1,631M | $1,631M | $1,631M |
| Recreation jobs | 187 | 187 | 187 | 187 | 187 | 187 |
| Recreation income | $4,527M | $4,527M | $4,527M | $4,527M | $4,527M | $4,527M |
| Ecosystem restoration jobs | 75 | 75 | 56 | 143 | 102 | 75 |
| Ecosystem restoration income | $2,907M | $2,907M | $2,163M | $5,511M | $3,946M | $2,889M |
| Predicted harvest levels/TSPQ (MMBF/year) | 27 | 29 | 16 | 76 | 56 | 36 |
| Allowable sale quantity (ASQ) ) (MMBF/year) | 51 | 51 | 31 | 73 | 51 | 51 |
| **Issue 3: Livestock grazing and grazing land vegetation (Umatilla NF)** | | | | | | |
| Acres suitable for permitted cattle grazing | 284,000 | 298,000 | 30,000 | 284,000 | 284,000 | 284,000 |
| Acres suitable for permitted sheep grazing | 60,000 | 28,000 | 13,000 | 42,000 | 42,000 | 42,000 |
| Permitted animal unit months (cattle) | 30,000 | 31,000 | 3,000 | 30,000 | 30,000 | 30,000 |
| Permitted animal unit months (sheep) | 7,800 | 4,600 | 1,200 | 5,800 | 5,800 | 5,800 |
| Rate of progress towards achieving rangeland vegetation desired condition | slow to moderate | slow to moderate | fastest | slow | moderate to fastest | moderate to fastest |

**Table 2. Key indicators for each alternative for the Umatilla National Forest**

| Key Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| **Issue 4: Old Forest (Umatilla NF)** | | | | | | |
| Acres of old forest within management area allocations with limited management activity | 142,000 | 188,000 | 322,000 | 176,000 | 191,000 | 191,000 |
| Acres of vegetation treatments per year in old forest | 300 | 500 | 0 | 2,900 | 1,000 | 500 |
| Percent old forest at year 50 (all potential vegetation groups) | 29 | 28 | 28 | 26 | 27 | 27 |
| Percent dry upland forest old forest single story at year 50 | 15 | 12 | 11 | 14 | 15 | 13 |
| **Issue 5: Preliminary Administratively Recommended Additions to the National Wilderness Preservation System (Umatilla NF)** | | | | | | |
| Acres of MA 1B | 0 | 1,400 | 248,500 | 0 | 40,100 | 40,100 |
| **Issue 6: Ecological Resilience (Umatilla NF)** | | | | | | |
| Annual forested vegetation active restoration activities (acres) | 16,950 | 17,400 | 14,000 | 20,100 | 23,400 | 18,700 |
| Miles of road treatments | 260 | 260 | 450 | 800 | 300 | 270 |
| Forage use intensity | 11.4% | 10.6% | 0.8% | 13.8% | 10.6% | 10.6% |
| Miles of riparian area improvement | 150 | 150 | 300 | 150 | 225 | 210 |
| Number of subwatersheds in improved condition | 23 | 23 | 25 | 25 | 23 | 23 |
| Improvement in the dry upland forest potential vegetation groups fire regime condition class departure score at year 50 (percent) | 20 | 23 | 17 | 35 | 35 | 28 |

**Table 3. Key indicators for each alternative for the Wallowa-Whitman National Forest**

| Key Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| **Issue 1: Access (Wallowa-Whitman NF)** | | | | | | |
| Miles of road maintained annually | 444 | 444 | 204 | 700 | 359 | 359 |
| Percent change in area available for route designation for summer motor vehicle use | 0% | minus-1% | minus-53% | minus-1% | minus-10% | minus-10% |
| Percent change in area available for winter over-the-snow vehicle use | 0% | negligible | minus-38% | minus-2% | minus-8% | minus-8% |
| **Issue 2: Economic and social well-being (Wallowa-Whitman NF)** | | | | | | |
| Timber harvest jobs | 201 | 245 | 104 | 845 | 506 | 329 |
| Timber harvest income | $11,112M | $13,526M | $5,723M | $46,722M | $28,000M | $17,716M |
| Livestock grazing jobs | 258 | 242 | 102 | 267 | 258 | 258 |
| Livestock grazing income | $3,435M | $3,241M | $1,304M | $3,556M | $3,435M | $3,435M |
| Recreation jobs | 397 | 397 | 397 | 397 | 397 | 397 |
| Recreation income | $7,678M | $7,678M | $7,678M | $7,678M | $7,678M | $7,678M |
| Ecosystem restoration jobs | 81 | 81 | 45 | 156 | 98 | 69 |
| Ecosystem restoration income | $2,582M | $2,582M | $1,449M | $5,001M | $3,143M | $2,215M |
| Predicted harvest levels/TSPQ (MMBF/year) | 24 | 27 | 15 | 80 | 50 | 34 |
| Allowable sale quantity (ASQ) ) (MMBF/year) | 46 | 46 | 22 | 75 | 46 | 46 |
| **Issue 3: Livestock grazing and grazing land vegetation (Wallowa-Whitman NF)** | | | | | | |
| Acres suitable for permitted cattle grazing | 408,000 | 393,000 | 135,000 | 422,000 | 408,000 | 408,000 |
| Acres suitable for permitted sheep grazing | 25,000 | 22,000 | 22,000 | 25,000 | 25,000 | 25,000 |
| Permitted animal unit months (cattle) | 77,000 | 74,000 | 26,000 | 80,000 | 77,000 | 77,000 |
| Permitted animal unit months (sheep) | 4,500 | 3,500 | 3,500 | 4,500 | 3,500 | 3,500 |
| Rate of progress towards achieving rangeland vegetation desired condition | slow to moderate | slow to moderate | fastest | slow | moderate to fastest | moderate to fastest |

**Table 3. Key indicators for each alternative for the Wallowa-Whitman National Forest**

| Key Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| **Issue 4: Old Forest (Wallowa-Whitman NF)** | | | | | | |
| Acres of old forest within management area allocations with limited management activity | 144,000 | 152,000 | 290,000 | 143,000 | 153,000 | 153,000 |
| Acres of vegetation treatments per year in old forest | 200 | 300 | 0 | 2,900 | 700 | 500 |
| Percent old forest at year 50 (all potential vegetation groups) | 22 | 21 | 21 | 20 | 21 | 21 |
| Percent dry upland forest old forest single story at year 50 | 9 | 8 | 7 | 11 | 11 | 9 |
| **Issue 5: Preliminary Administratively Recommended Additions to the National Wilderness Preservation System (Wallowa-Whitman NF)** | | | | | | |
| Acres of MA 1B | 0 | 10,800 | 172,700 | 0 | 20,300 | 20,300 |
| **Issue 6: Ecological Resilience (Wallowa-Whitman NF)** | | | | | | |
| Annual forested vegetation active restoration activities (acres) | 17,650 | 18,150 | 14,450 | 22,650 | 23,450 | 19,850 |
| Miles of road treatments | 260 | 260 | 400 | 800 | 300 | 270 |
| Forage use intensity | 12% | 12% | 3% | 17% | 12% | 12% |
| Miles of riparian area improvement | 250 | 250 | 500 | 250 | 375 | 350 |
| Number of subwatersheds in improved condition | 4 | 4 | 14 | 2 | 5 | 4 |
| Improvement in the dry upland forest potential vegetation groups fire regime condition class departure score at year 50 (percent) | 5 | 7 | 4 | 16 | 16 | 11 |

# Management Areas

The following tables display the management area designations and allocations for each of the alternatives. The 1990 forest plans created a variety of management areas that are not consistent across the three national forests. A new management area identification scheme is used in this document. In order to compare alternatives, the existing management areas for each national forest were reclassified into this new scheme. Therefore, alternative A is described using the same management area designations as alternatives B through F.

All management areas acres are displayed in full. Overlap occurs between most management areas but is not accounted for in these tables. The overlapping management areas result in the total acreage of all management areas being greater than the official national forest acreages. For example, several research natural areas (MA 2B) and wild and scenic rivers (MA 2A) overlap into congressionally designated wilderness areas (MA 1A).

For alternatives B, C, D, E, and F, the wilderness area acres have been recalculated for comparison purposes using the most current GIS technology. No additions or subtractions to any wilderness areas were made since the 1990 forest plans were approved and signed. Acres of private land inclusions are not included in any wilderness area acre calculations, except where noted.

The figures in the tables are rounded to the nearest 100 (acres) or to the nearest whole mile except for alternative A.

The management area acres table for the Malheur National Forest (table 4) includes acres from the portion of the Ochoco National Forest managed by the Malheur National Forest.

The management areas acre table for the Wallowa-Whitman National Forest does not include the Hells Canyon National Recreation Area (HCNRA). Scenic byways and national designated trails within the HCNRA are also excluded.

The 1990 forest plans do not have management areas designated for recommended wilderness areas, eligible wild and scenic rivers, scenic byways and All-American Roads, or nationally designated trails. Individual national forests may recognize roads, trails and areas, but they were not designated as management areas in the 1990 forest plans (alternative A).

Refer to the map packet for maps of the management areas for each national forest for each alternative.

**Table 4. Management area designation, name, and acreage (miles for 2F and 2G) for each alternative for the Malheur National Forest**

| Management Area Designation and Name | Alt. A | Alt. B | Alt. C | Alt. D | Alts. E and F |
|---|---|---|---|---|---|
| 1A Congressionally Designated Wilderness Areas* | 82,557 | 82,600 | 82,600 | 82,600 | 82,600 |
| 1B Preliminary Administratively Recommended Wilderness Areas | NA | 1,200 | 83,800 | NA | 30,400 |
| 2A Designated and Eligible Wild and Scenic Rivers (does not include eligible wild and scenic rivers for alternative A) | 10,807 | 12,100 | 12,100 | 12,100 | 12,100 |
| 2B Research Natural Areas | 3,426,114 | 11,100 | 11,100 | 11,100 | 11,100 |
| 2C Botanical Areas | 30 | 100 | 100 | 100 | 100 |
| 2D Geological Areas | 40 | 200 | 200 | 200 | 200 |
| 2E Historical Areas | NA | 34,000 | 34,000 | 34,000 | 34,000 |
| 2F Scenic Byways and All-American Roads | NA | 13 miles | 13 miles | 13 miles | 13 miles |
| 2G Nationally Designated Trails | NA | 9 miles | 9 miles | 9 miles | 9 miles |
| 2H Scenic Areas | 14,399 | 14,400 | 14,400 | 14,400 | 14,400 |
| 2J Municipal Watersheds | 519 | 500 | 500 | 500 | 500 |
| 3A Backcountry(nonmotorized use) | 47,535 | 59,300 | 270,400 | NA | 53,600 |
| 3B Backcountry (limited motor vehicle use) | 14,652 | 129,100 | NA | 165,800 | 119,100 |
| 3C Wildlife Corridor | NA | NA | 167,700 | NA | NA |
| 4A General Forest | 851,877 | 1,252,000 | 702,500 | 1,359,800 | 1,245,600 |
| 4B Riparian Management Areas** | 88,593 | 149,900 | 172,400 | 66,000 | 148,800 |
| 4C Old Forest | 84,232 | NA | 205,100 | NA | NA |
| 4D Big Game Winter/Summer Range | 293,453 | NA | NA | NA | NA |
| 4E General Wildlife/Fish | 50,741 | NA | NA | NA | NA |
| 4F Visuals | 217,328 | NA | NA | NA | NA |
| 5 Developed Sites and Administrative Areas | 647 | 2,200 | 2,200 | 2,200 | 2,200 |

* The designated wilderness area acres displayed for alternative A are taken from the 1990 forest plans and have not been recalculated using current technology. Private inclusions are included in the total for congressionally designated wilderness areas for alternative A.

** MA 4A does not include riparian management area acres. MA 4B includes only the riparian area acres that would have been allocated to MA 4A General Forest (these acres are not included in the MA 4A total).

**Table 5. Management area designation, name, and acreage (miles for 2F and 2G) for each alternative for the Umatilla National Forest**

| Management Area Designation and Name | Alt. A | Alt. B | Alt. C | Alt. D | Alts. E and F |
|---|---|---|---|---|---|
| 1A Congressionally Designated Wilderness Areas* | 304,173 | 304,200 | 304,200 | 304,200 | 304,200 |
| 1B Preliminary Administratively Recommended Wilderness Areas | NA | 1,400 | 248,500 | NA | 40,100 |
| 2A Designated and Eligible Wild and Scenic Rivers (does not include eligible wild and scenic rivers for alternative A) | 6,926 | 44,600 | 44,600 | 44,600 | 44,600 |
| 2B Research Natural Areas | 11,224 | 11,000 | 11,000 | 11,000 | 11,000 |
| 2C Botanical Areas | 817 | 2,400 | 2,400 | 2,400 | 2,400 |
| 2D Geological Areas | 416 | 400 | 400 | 400 | 400 |
| 2E Historical Areas | 1,178 | 1,200 | 1,200 | 1,200 | 1,200 |
| 2F Scenic Byways and All-American Roads | NA | 51 miles | 51 miles | 51 miles | 51 miles |
| 2G Nationally Designated Trails | NA | 30 miles | 30 miles | 30 miles | 30 miles |
| 2H Scenic Areas | 31,109 | 31,100 | 31,100 | 31,100 | 31,100 |
| 2J Municipal Watersheds | 12,581 | 20,200 | 20,200 | 20,200 | 20,200 |
| 3A Backcountry (nonmotorized use) | 29,760 | 19,300 | 105,800 | NA | 70,100 |
| 3B Backcountry (limited motor vehicle use) | 11,909 | 240,900 | NA | 218,700 | 160,600 |
| 3C Wildlife Corridor | NA | NA | 91,900 | NA | 21,600 |
| 4A General Forest | 296,180 | 640,300 | 329,000 | 742,300 | 625,200 |
| 4B Riparian Management Areas** | 69,776 | 118,700 | 178,100 | 58,100 | 116,100 |
| 4C Old Forest | 44,277 | NA | 94,800 | NA | NA |
| 4D Big Game Winter/Summer Range | 130,215 | NA | NA | NA | NA |
| 4E General Wildlife/Fish | 430,166 | NA | NA | NA | NA |
| 4F Visuals | 65,775 | NA | NA | NA | NA |
| 5 Developed Sites and Administrative Areas | 4,922 | 3,700 | 3,700 | 3,700 | 3,700 |

* The designated wilderness area acres displayed for alternative A are taken from the 1990 forest plans and have not been recalculated using current technology. Private inclusions are included in the total for congressionally designated wilderness areas for alternative A.

** MA 4A does not include riparian management area acres. MA 4B includes only the riparian area acres that would have been allocated to MA 4A General Forest (these acres are not included in the MA 4A total).

**Table 6. Management area designation, name, and acreage (miles for 2F and 2G) for each alternative for the Wallowa-Whitman National Forest**

| Management Area Designation and Name | Alt. A | Alt. B | Alt. C | Alt. D | Alts. E and F |
|---|---|---|---|---|---|
| 1A Congressionally Designated Wilderness Areas* | 373,676 | 372,900 | 372,900 | 372,900 | 372,900 |
| 1B Preliminary Administratively Recommended Wilderness Areas | NA | 10,800 | 172,700 | NA | 20,300 |
| 1C Wilderness Study Area | 2,350 | 2,400 | 2,400 | 2,400 | 2,400 |
| 2A Designated and Eligible Wild and Scenic Rivers (does not include eligible wild and scenic rivers for alternative A) | 21,936 | 84,400 | 84,400 | 52,900 | 52,900 |
| 2B Research Natural Areas | 2,635,897 | 8,000 | 7,255 | 8,000 | 7,255 |
| 2E Historical Areas | 0 | 0 | 0 | 0 | 0 |
| 2F Scenic Byways and All-American Roads | NA | 85 miles | 85 miles | 85 miles | 85 miles |
| 2G Nationally Designated Trails | NA | 25 miles | 25 miles | 25 miles | 25 miles |
| 2I Starkey Experimental Forest and Range | 27,251 | 30,500 | 30,500 | 30,500 | 30,500 |
| 2J Municipal Watersheds | NA | 24,500 | 24,500 | 24,500 | 24,500 |
| 3A Backcountry(nonmotorized use) | NA | NA | 210,100 | NA | 104,400 |
| 3B Backcountry (limited motor vehicle use) | 119,938 | 248,800 | NA | 219,500 | 145,500 |
| 3C Wildlife Corridor | NA | NA | 242,600 | NA | 6,500 |
| 4A General Forest | 734,500 | 848,000 | 397,200 | 998,700 | 844,300 |
| 4B Riparian Management Areas** | 121,683 | 184,600 | 200,800 | 87,100 | 186,300 |
| 4C Old Forest | 60,285 | NA | 91,000 | NA | NA |
| 4D Big Game Winter/Summer Range | 396,703 | NA | NA | NA | NA |
| 4E General Wildlife/Fish | 60,326 | NA | NA | NA | NA |
| 4F Visuals | 4,287 | NA | NA | NA | NA |
| 5 Developed Sites and Administrative Areas | 7,111 | 7,700 | 7,700 | 7,700 | 7,700 |

* The designated wilderness area acres displayed for alternative A are taken from the 1990 forest plans and have not been recalculated using current technology. Private inclusions are included in the total for congressionally designated wilderness areas for alternative A.

** MA 4A does not include riparian management area acres. MA 4B includes only the riparian area acres that would have been allocated to MA 4A General Forest (these acres are not included in the MA 4A total).

# Chapter 3. Affected Environment and Environmental Consequences

## Introduction

Chapter 3 describes the affected environment and environmental consequences from implementing the alternatives described in chapter 2and appendix A in relation to the significant and other issues described in chapter 1. This chapter provides the reader with the affected environment and environmental consequences of the modified proposed action, no action and four other "action" alternatives for each resource. The affected environment is discussed by resource, rather than in its own chapter, in order to facilitate the readers understanding of the context of the environmental consequences that follow. Each resource has a brief introduction. As required by the 40 CFR 1502.14, the resource specialist provides an explanation of the analysis methodology that was used in drawing their effects analysis in appendix B. The Environmental Consequences section is grouped by each alternative or by the action alternatives versus the No-action Alternative. This chapter touches on a variety of resources. The organization is loosely structured around the issues and then by environment type. The issues are access, economic and social well-being, livestock grazing and grazing land vegetation, old forest, recommended wilderness areas, and ecological resilience. The environment types include physical, biological and social environments. As required by 40 CFR 1502.23, the "Economic and Social Well-Being Environmental Consequences" section, provides a basis for the cost-benefit analysis of this work towards contributing to local economic stability. Watershed and soil resources are discussed under the physical environment. Appendix D provides details on the legal regulatory compliance.

### The Analysis Area

The analysis area includes the National Forest System lands (NFS lands) administered by the Malheur, Umatilla, and Wallowa-Whitman National Forests, with one exception: the Hells Canyon National Recreation Area portion of the Wallowa-Whitman National Forest is not included (as discussed in chapter 1). The analysis area for the Malheur National Forest also includes an adjacent portion of the Ochoco National Forest that is administered by the Emigrant Creek Ranger District. These national forests are collectively referred to as the Blue Mountains national forests. For ease of reference and to conserve space in tables, Forest Service designators for the national forests may be used: MAL, UMA, WAW, and OCH for the Malheur, Umatilla, Wallowa-Whitman, and Ochoco National Forests respectively.

### The Analysis of Environmental Consequences

NEPA requires the analysis and disclosure of direct, indirect, and cumulative effects to the affected environment. Environmental consequences are interchangeable with effects. The analysis of these anticipated effects provides a basis for comparing alternatives and a method by which the interdisciplinary team, the public, and the responsible official can assess the consequences through time and in a particular geographic area. Appendix B to this DEIS includes the methodologies used in this analysis.

## Programmatic Analysis

The impacts addressed in a programmatic plan revision EIS reflect the environmental issues associated with the programmatic nature of the plan. Because these issues typically relate to environmental effects over a broad geographic and time horizon, the depth and detail of impact analysis is expected to be broad and general. The effects analysis will focus on the major impacts that might result in the long term if the plan is implemented, especially on those resources or factors that would be adversely impacted.

For estimating the effects at the programmatic forest plan level, the assumption has been made that the kinds and amounts of resource management activities described in the alternatives are reasonably foreseeable actions intended to move towards or achieve the goals and desired conditions. However, the specific location, design, and extent of such activities are generally not known at the time. As described in chapter 1, project level decisions that actually implement the forest plan are made on a site-specific basis. Therefore, the discussions here refer to the potential for the effect to occur and are in many cases only estimates. The effects analyses are useful when comparing and evaluating alternatives on a forestwide basis, but are not intended to be applied directly to site-specific locations within the national forests.

**Direct effects** are not analyzed in this programmatic document because the actions are not tied to a specific place or location. Land management plans typically do not have direct effects, as they generally do not authorize site-specific projects. Direct effects can only be analyzed on site-specific projects that would cause a specific action to occur in a particular time and location. Plans may prohibit some actions that might be taken or might not have otherwise been proposed; however, plans do not compel actions to be taken. Instead, plans influence what might or might not be proposed in the future, and the nature of those actions.

**Indirect effects** are caused by an action and occur later or are removed in distance. The effects of programmatic direction are generally indirect effects.

A **cumulative effect** is the effect of an action when added to the effects of other past, present, and reasonably foreseeable future actions, regardless of which agency or person undertakes the actions and regardless of who owns the land on which the other actions occur. The cumulative effects analysis integrates the actions and activities occurring on other national forests and lands of other ownership into a broader “landscape” analysis. The cumulative effects area includes all lands within the proclaimed boundaries of the three national forests and the portion of the Ochoco National Forest that is administered by the Malheur National Forest. It also includes the HCNRA, private, state, and other federally administered lands within and adjacent to the national forest boundaries.

The provisions of the 1982 planning rule include requirements to coordinate planning efforts with local land owners as well as related planning efforts of other Federal agencies, State and local governments, and Indian tribes (1982 rule provisions 219.6(k) and 219.7(c)). The analysis compares relevant plans and policies to the alternatives developed for National forest System lands, and then describe what the “effects” would be at that multi-land ownership level. It also describes whether and how the effects of each alternative accrue cumulatively with the effects of the plans and policies reviewed. This review is focused on the long-term outcomes of these plans as they pertain to the broader landscape. The results of this review are displayed in the environmental impact statement. The plans and policies are incorporated by reference.

This cumulative effects list does not attempt to quantify the effects of past human actions by adding up all prior actions on an action-by-action basis (appendix C). There are several reasons for not taking this approach. First, a catalog and analysis of all past actions would be impractical to compile and unduly costly to obtain. Current conditions have been impacted by innumerable actions during the last century (and beyond) and trying to isolate the individual actions that continue to have residual impacts would be nearly impossible. Second, providing the details of past actions on an individual basis would not be useful to predict the cumulative effects of the proposed action or alternatives. In fact, focusing on individual actions would be less accurate than looking at existing conditions, because information about the environmental impacts of individual past actions is limited and one cannot reasonably identify each and every action during the last century that has contributed to current conditions. Focusing on the impacts of past human actions risks ignoring the important residual effects of past natural events, which may contribute to cumulative effects just as much as human actions. By analyzing current conditions, all the residual effects of past human actions and natural events are sure to be captured, regardless of which particular action or event contributed those effects. Third, public scoping for this project did not identify any public interest or need for detailed information on individual past actions. Finally, the Council on Environmental Quality issued an interpretive memorandum on June 24, 2005, regarding analysis of past actions, which states, “agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.”

For these reasons, the assessment of current environmental conditions in the affected environment incorporates the combined effects of past actions. Ongoing and reasonably foreseeable future actions are addressed within the analysis in environmental consequences. Because the forest plan has an anticipated lifespan of 15 to 20 years, this analysis incorporates the effects of reasonably foreseeable future actions. When forest plan activities are considered within a context of climate change, an additional factor is added to the cumulative effects analysis.

The direct, indirect and cumulative effects analyses incorporate the data files that are available from the analysis file (referred to as the project record).

# Consideration of Climate Change

Climate change is affecting the processes that define natural and human systems in the Pacific Northwest. Relative changes in temperature, precipitation, and carbon dioxide concentrations have implications for the amount and seasonality of water availability. These influences consequently effect the geographic locations that are habitable by particular plant and animal species, species abundance, the productive capacity of natural and human systems, and risks to natural and human systems from extreme events, such as floods. Changes in hydrologic processes are also important because they determine when water is available and how it must be stored for use by natural and human systems.

Understanding of regional trends in climate across the Pacific Northwest is becoming clearer with time, while finer-scale trends, such as the Blue Mountains, are less certain. Average annual temperatures in the Pacific Northwest have risen by 1.5 °F since 1900. Since 1950, temperatures have risen at twice the rate of increase that occurred before 1950 (Mote 2003a). Temperatures are expected to increase by 0.2 to 1 °F per decade throughout the 21st century, and temperatures are expected to rise for the next several decades or longer, even if emissions stopped today (Mote and Salathé 2009). Compared to 1970 to 1999, temperatures are expected to be 2.8 to 9.7 °F warmer by 2100 (Littell et al. 2009a).

Trends in historical and projected changes in precipitation in the Pacific Northwest are less clear than for temperature. For example, precipitation in the Pacific Northwest has increased by 13 to 38 percent since 1900 and has shown substantial inter-annual and decadal variability during the 20th century (Mote 2003a). Littell et al. (2009a) showed that projected increases in annual precipitation for the Pacific Northwest vary considerably between models. Average model increases in precipitation relative to the period from 1970 to 1999 were 1.3, 2.3, and 3.8 percent for the 2020s, 2040s, and 2080s, respectively. Ranges in these model estimates were minus-9 to plus-12 percent, minus-11 to plus-12 percent, and minus-10 to plus-20 percent, respectively.

While temperature data in the Blue Mountains appears to track regional trends fairly well, regional averages in precipitation for the Pacific Northwest may differ from those in the Blue Mountains due to complex local terrain and the position of the Blue Mountains relative to prevailing air masses and storm tracks. Based on average data for Blue Mountains (Oregon climate zone 8), average precipitation is lower since 1970 for every month except April, July, and August. Cool season (October through March) precipitation is lower by 14 percent; warm season precipitation (April through September) is lower by 2 percent; July and August precipitation is higher by 27 percent. Changes at individual stations within and near the Blue Mountains may vary greatly from these averages (Gecy 2010). The difference between observed changes in precipitation in the Blue Mountains and the Pacific Northwest region illustrate that climate changes are not homogeneous and that local differences in weather pattern, topography, and other factors that influence the distribution of precipitation may be important in future assessments of climate change response.

April 1 snowpack has declined in mountainous regions across the West (Mote 2003b, Mote et al. 2005), with observed changes largely being attributed to elevated temperatures in both winter and spring (Hamlet et al. 2005, Stewart et al. 2005). Similar changes are observed in the Blue Mountains where all but 2 of 34 measuring stations have recorded declines in April 1 snowpack since 1970, with an average decline of 24 percent and a range of 5 to minus-73 percent (Gecy 2010). Snowpack declines are expected to continue across the Blue Mountains as temperatures throughout the region increase. Continued warming is expected to result in more winter precipitation falling as rain rather than snow and less winter snow accumulation. Watersheds in which runoff presently results from a mixture of rain and snow are likely to become rain dominated by 2100. These changes are projected to result in reduced peak spring streamflow, increased winter streamflow, and reduced late summer flow. In low elevation areas where winter temperatures are at the threshold of freezing, winter precipitation is expected to become increasingly dominated by rain instead of snow (Mote 2003b, Hamlet et al. 2005, and Mote et al. 2005), and winter streamflow will become higher and more variable (Elsner et al. 2010). Overall, earlier snowmelt and longer warm periods is expected to lead to a shift of peak river runoff to early spring or winter (Barnett et al. 2005). Streamflow projections suggest that there will be higher annual streamflow with lower summer flows and higher and more variable winter flows (Hamlet and Elsner 2010). In the Blue Mountains, all 16 measuring stations with streamflow records beginning prior to 1940 show an increase in March runoff, and most show decreased June runoff. Reduced summer streamflow has not yet been observed.

The projected increase in air temperatures and the resulting effect on snow pack and timing and magnitude of rainfall is predicted to have considerable impact on natural resources and their management in the region and in the Blue Mountains (for more detail, refer to specific resource sections in this chapter.) Further, higher temperatures result in more energy input to the biophysical environment and an increased ability of the atmosphere to hold moisture; hence, some weather events and extremes will become more frequent, more widespread, or more intense during the 21st century (Parry et al. 2007).

## Climate Change Effects on the Terrestrial Environment

Significant impacts to terrestrial ecosystem structure and function are expected as a consequence of climate change. Climate-vegetation interactions are expected to produce a number of terrestrial ecosystem disturbance effects, including increased fire frequency and severity and increased susceptibility to insects and disease and invasive species. Within the region, increased summer temperature and decreased summer precipitation are projected to result in a doubling of the area burned by fire by the 2040s and a tripling by the 2080s. The probability of very large fires (more than two million acres) in a given year is projected to increase from 5 percent (observed) to 33 percent by the 2080s. Primarily east of the Cascades, mountain pine beetles will likely reach higher elevations and pine trees experiencing stress from changing climatic conditions will likely be more vulnerable to infestations by beetles (Littell et al. 2009b).

Changes in the length of the growing season, the timing of bud break (phenology), and the availability of soil moisture are expected to produce large shifts (both positive and negative) in forest growth and mortality rates, forest floor decomposition, and species composition in forest ecosystems. There is correspondence between earlier spring green up and the early onset of spring snowmelt runoff in western North America (Cayan et al. 2001). For wildlife, changes in climate and vegetation will affect habitat (i.e., cover), reproductive success, and food and water availability. These impacts in turn will alter species assemblage, migration routes, and viability of populations, particularly rare species and large mammals that may have greater sensitivity to these ecosystem and climatic changes. Anticipated changes to wildlife include:

- The susceptibility of high elevation habitats and species dependent on snowpack (e.g., wolverine)
- Impacts on wetlands and associated species, especially those sensitive to water temperature (e.g., tailed frog)
- Phenological mismatch between migratory bird movements and their habitat

Changes are expected to happen more quickly than species' abilities to adapt, thus connectivity to allow movement of species will be critical (for more detail, refer to the Terrestrial Wildlife Diversity and Viability section in this chapter).

Management strategies to increase the adaptive capacity of terrestrial ecosystems in the face of climate change include:

- Conserving species and habitats threatened directly or indirectly by climate change
- Enhancing landscape connectivity
- Reducing barriers to species movement caused by shifts in habitat distributions
- Reducing the risk of uncharacteristically severe fires and insects and disease disturbances
- Reducing the extent of nonnative invasive species and preventing future infestations

## Climate Change Effects on the Aquatic Environment

Increasing air temperatures, decline in snowpack and changes in the magnitude and timing of rainfall are expected to reduce summer streamflow, increase cool season streamflow, and increase stream temperatures at least during the next century throughout the Pacific Northwest. These changes in streamflow and temperature have the potential to directly impact aquatic habitat and organisms. For example, bull trout and salmon populations may be directly impacted and could decline through these anticipated changes. Changes in the timing of streamflow and scouring of stream habitat due to increased rain on snow events are expected to affect the quality and quantity of habitat for aquatic species and the development and timing of emergence of aquatic insects (Mantua et al. 2009).

Management strategies to increase the adaptive capacity of aquatic ecosystems in the face of climate change include:

- Reducing potential increases in stream temperatures through riparian buffers
- Restoring and the maintaining effective stream shade
- Reducing the risk of water quality degradation and increasing aquatic connectivity by:
    - Decreasing road density
    - Reducing hydrological connectivity of the road system
    - Replacing culverts
    - Closing, realigning, or obliterating roads

## Carbon Sequestration and Mitigation of Greenhouse Gas Emissions

Ecosystems are affected not only by climate change but also through carbon sequestration (e.g., plant growth) and greenhouse gas emissions (e.g., fire, organic matter decomposition, and soil respiration). Ecosystem functions also directly influence the global carbon cycle. The Forest Service administers roughly one-fifth of all U.S. forestland, and management of these forests can substantially affect total national forest carbon stocks (Heath et al. 2011). Consequently, the Forest Service roadmap for responding to climate change (USDA Forest Service 2010) identified assessing and managing carbon stocks as a part of the strategy.

Forest management can offset greenhouse gas emissions by increasing capacity for carbon uptake and storage in biomass, wood products, and soils. In general, while deforestation is a large global source of $CO_2$, forestland area the United States has declined only slightly, and the forestry sector is in fact a net greenhouse gas sink in the U.S. (USDA Forest Service2008). Forests of the Blue Mountains currently store substantial carbon stocks. Forest management activities and disturbances, such as wildland fire, can either increase or reduce carbon stocks over time, depending on their type, frequency, and severity. In general, current Forest Service management activities are unlikely to affect carbon stocks substantially in the Blue Mountains.

Carbon is also stored in wood products that are harvested from Oregon’s forests, but wood products are unlikely to provide for substantial increases in stored carbon under current manufacturing, use, and disposal practices. Management activities carried out in response to climate change, such as thinning of forests to reduce risk of stand replacing wildland fire or insects disturbances, or to reduce moisture stress on the remaining trees, may reduce carbon stocks in the short term, but can have long-term benefits for carbon sequestration (Zhang et al. 2010). Rangeland carbon stocks are lower than forests and are less directly affected by rangeland management practices than timber harvests in forestlands (U.S. EPA 2011).

## Adaptation to Climate Change

All forest plan alternatives include outcomes or allow for management actions that would improve the ability of national forest resources to adapt to a changing climate. The alternatives vary in the amount of outcomes and types of actions that are likely to occur. Forest plan components appropriate for addressing climate change include the following:

- Conserving species and habitats threatened directly or indirectly by climate change, enhancing landscape connectivity, and reducing barriers to species movement to facilitate the ability of species to move across the landscape with shifts in habitat distributions (desired conditions 1.1, 1.2, 1.7, and 1.12 and objectives 1.1 and 1.2)
- Reducing the risk of uncharacteristically severe fires and insects and disease disturbances through forest thinning (desired conditions 1.4.1, 1.4.2, 1.7, and 1.8 and objectives 1.1, 1.4.1, 1.4.2, 1.6, and 1.8)
- Reducing the risk of increased nonnative species infestations through reductions in the extent of current nonnative species and prevention of future infestations (desired condition 1.5 and objective 1.5)
- Reducing potential increases in stream temperatures through riparian buffers and stream restoration and maintenance of effective stream shade (desired condition 1.1 and objective 1.1)
- Reducing risk of water quality degradation while increasing aquatic connectivity by decreasing road density, reducing hydrological connectivity of the road system, replacing culverts, and road closure, realignment or obliteration (desired condition1.1 and objective 1.1)

The referenced forestwide desired conditions and forestwide objectives are described in more detail in appendix A.

These management approaches, once implemented, should result in landscapes that are more resistant to catastrophic wildland fires and insects and disease disturbances, are more resilient in the wake of extreme weather events, and are better able to adapt to changing conditions.

Climate change effects are discussed in detail in the individual resource sections in this chapter. Relative comparisons of the degree of climate change adaptation between alternatives are based on evaluation of one or more of the following indicators:

- Acres available for planting (even-aged harvest) and providing opportunities to adapt tree species composition to changing climates
- Acres of designated wildlife corridors, which can reduce barriers to movement
- Acres of thinning to restore disturbance regimes and/or reduce uncharacteristically severe wildland fires
- Miles of roads with improved drainage and reduced sediment delivery, thus reducing hydrologic connectivity of the road system

- Miles of riparian restoration, which restores floodplain connectivity, flow regimes, and/or increases effective stream shade
- Acres of invasive plants treated

## Addressing Uncertainty through Adaptive Management

The effects of climate change on ecosystem structure and function and the effectiveness of management activities in climate adaptation are just a couple of many uncertainties in natural resource management. At this point, much of what is understood about climate change is based on models that are built on the best available scientific information and assumptions. There is relatively less direct experience observing how climate change is playing out in its effect on ecosystems, how management actions may help ecosystems adapt to a changing climate, and how model assumptions compare to reality. Varying levels of uncertainty still remain across climatic variables, across spatial and temporal scales, and across management objectives. For example, within the region, trends in warming temperatures, declining winter snow packs, and earlier spring snowmelt are relatively more clear than trends in precipitation. Further, it is challenging to interpret local variations in precipitation within the context of regional long-term trends. These types of uncertainties complicate the design of land management actions that may be needed to take to adapt to climate change. However, the understanding of regional trends in climate across the Pacific Northwest is becoming clearer with time, and will continue to do so as monitoring and research data builds. The likely effects of climate change on the distribution of plant and animal species and their biophysical environment (described in detail within specific resource sections in this chapter), as well as the potential adaptation actions that can be taken in response, will also become more clear with time. In any case, surprising trends and the need to consider how management actions now will maintain opportunities to respond to surprises in the future is relatively certain.

Fundamentally, managing to restore and maintain ecosystem resilience to change is a key forest plan revision strategy, as represented by the plan components described previously and others detailed in appendix A. However, compared to what is known about likely future conditions, desired conditions in the forest plan, including those aimed to restore or maintain ecosystem resilience, are biased by the greater body of knowledge available about historical ecological and social conditions. Hence, land managers must also be cognizant of how desired conditions may need to change as a better understanding of ecosystem and social capabilities and desires emerges in response to climate change.

Key components to addressing climate change impacts on ecosystems (both freshwater and terrestrial) include focusing on monitoring to reduce uncertainties in the understanding of climate change and ecosystem responses, the efficacy of management to facilitate adaptation and changes to desired conditions. Adaptive management is an approach for testing assumptions and reducing uncertainty over time. The Blue Mountains forest plan revision incorporates monitoring elements that facilitate evaluation of assumptions about interactions between weather, ecosystem structure and function, natural disturbances, and outcomes of management objectives (see monitoring plan, appendix A). Through local and regional monitoring and by staying abreast of the best available information, management assumptions can in turn be adjusted and be positioned to continually improve national forest management in a changing climate.

# Significant Issues

## Issue 1: Access

Access to the national forests, including access for recreation, administrative use, permitted activities, valid existing rights, and firefighting, was identified as a significant issue during scoping. The issue involves road and trail access for motor vehicles, road access for managing resources, the cost of maintaining the transportation system, and the desire to reduce motor vehicle route density (and therefore access) to improve fish and wildlife habitat and to protect streams. Access is best analyzed and discussed as whether an area is generally suitable or unsuitable for motor vehicle and nonmotorized uses.

An additional aspect of areas that would be generally suitable or unsuitable for motor vehicle use is the social response to these designations. Conflicts between users may be minimized by having areas that are clearly designed and designated for either motor vehicle use or nonmotorized use.

While the forest plan would not change designations of roads and trails for motor vehicle use, it would provide direction for future planning. Specifically, the forest plan would include determinations (generally suitable or unsuitable for motor vehicle use) that dictate whether or not motor vehicle routes can be constructed or reconstructed in an area. The areas that would be generally unsuitable for motor vehicle use would be dominated by nonmotorized uses.

Motor vehicle access is desired for hunting and fishing, summer and winter recreation, private land access, management activities, and wildland fire suppression. Nonmotorized areas are needed for hunting and fishing, summer and winter recreation, secluded wildlife habitat, and biological reserves. The number of acres suitable for motor vehicle use and the desired conditions for road density in those areas will influence the future transportation system and future road management opportunities. The amount and type of access to an area is an important factor affecting the health of terrestrial, aquatic, and riparian habitats.

The amount and type of access available within the national forests is a large component of recreation, wildlife, fisheries, and watershed effects and is discussed in more detail in the corresponding resource sections. The focus of this section is access to the national forests for all uses.

The amount of area within each national forest that is generally suitable for motor vehicle use (summer and winter) varies by alternative and is one measure of the differences between alternatives.

Identification of an area as generally suitable or generally unsuitable for a use guides future project and activity decision making. For instance, if an area that is suitable for motor vehicle use in the 1990 forest plans is determined to be unsuitable for that use in the revised forest plans, the new determination does not result in immediate closure of roads in that area. Rather, that suitability determination would be considered in making future project level decisions. Those site-specific decisions may include road closures in the area. An area determined to be unsuitable for motor vehicle use is expected to have no future road or motor vehicle trail construction.

In 2005, the Forest Service published the travel management rule, governing use of motor vehicles on National Forest System lands. The Code of Federal Regulations Title 36, Part 212 has two subparts that provide direction for travel management in national forests. The first portion of that rule, also known as subpart A, stipulates the administration of national forest transportation systems and includes how road systems are to be managed. In 36 CFR 212.5 (b) the responsible official must identify the minimum road system needed for safe and efficient travel and for administration, utilization, and protection of National Forest System lands. This requires a science-based roads analysis at the appropriate scale involving a broad spectrum of interested and affected citizens, state and Federal agencies, and tribal governments. The minimum system is the road system determined to be needed to meet resource and other management objectives adopted in the relevant land and resource management plan (36 CFR part 219) to meet applicable statutory and regulatory requirements, to reflect long-term funding expectations, and to ensure that the identified system minimizes adverse environmental impacts associated with road construction, reconstruction, decommissioning, and maintenance. The forest plan revision will help inform this subpart A requirement.

The travel management rule (36 CFR part 212, subpart B) requires each administrative unit or ranger district to designate those National Forest System roads, National Forest System trails, and acres of National Forest System lands that are open to motor vehicle use by vehicle class and, if appropriate, by time of year. The travel management rule also requires designated roads, trails, and areas to be identified on a motor vehicle use map (MVUM). After designated roads, trails, and areas have been identified on a MVUM, motor vehicle use inconsistent with those designations is prohibited by 36 CFR 261.13.

The travel management rule combines regulations governing administration of the national forest transportation system and regulations governing use of motor vehicles off National Forest System roads. The travel management rule implements Executive Order (E.O.) 11644 (February 8, 1972) “Use of Off-Road Vehicles on the Public Lands,” as amended by E.O. 11989 (May 24, 1977).

The forest plan revision process does not include determinations for whether or not specific roads and trails will be constructed, maintained, closed, or decommissioned. The primary ways that the transportation system is managed during a plan period are by goals and desired conditions, including open motor vehicle route density, and the general suitability of an area for motor vehicle use or, conversely, the general suitability of an area for nonmotorized use only. Decisions on motor vehicle access are made through individual project planning and are reflected on the individual national forest annual motor vehicle use map (MVUM). When the forest plans were approved in 1990, cross-country motor vehicle travel was prohibited within much of the Umatilla National Forest. The remaining area that was open to cross-country motor vehicle travel was closed in 2010. In contrast, the 1990 forest plans for the Malheur and Wallowa-Whitman National Forests did not prohibit cross-country travel, unless an area was closed to it by order.

It is assumed that cross-country motor vehicle travel within the Malheur and Wallowa-Whitman National Forests will be limited when their travel management plans are completed and implemented. After implementation of the travel management plans, all three national forests will be in compliance with the 2005 Travel Management Rule (36 CFR 212). The forests are waiting on national direction with regards to how to address over-the-snow motor vehicles.

## Affected Environment – Access

Access to the Malheur, Umatilla, and Wallowa-Whitman National Forests is provided by a complex and integrated transportation system of roads and trails managed by the Forest Service, county, state, and private jurisdictions. National Forest System roads range from double-lane paved highways to narrow, native-surface roads. The entire road system for all three national forests includes more than 22,000 miles of roads. Roads are an important part of the infrastructure in the Blue Mountains national forests and provide access for recreation activities, timber removal, grazing, wildfire protection, and to facilities that are operated under special use authorizations. However, roads also have the potential to adversely affect a number of resources in various ways. Please note that roads and trails are collectively referred to as routes.

The information for this analysis was acquired from agency documentation of historical maintenance funding and practices, as well as agency data on the transportation system (INFRA).

The history and development of the road systems of the Blue Mountains national forests is primarily related to extractive resource management activities, such as mining and logging, which included constructing transportation infrastructure as it progressed. Many roads were located directly adjacent to streams and rivers because mining operations were often associated with water. Lode mining necessitated the construction of roads and railroads to haul the ore. Logging operations often followed mining operations because timbers were needed to shore up tunnels or build cabins. Prior to the dependency on trucks, railroads provided the primary access into the area. Railroad logging can be traced as far back as 1901, and signs of this activity remain today, as evidenced by the numerous railroad grades throughout the area.

Additional roads were constructed to connect communities and for firefighting and administrative access to the national forests. Roads provided access for viewing scenery, reaching traditional campsites and hunting areas, grazing, and gathering forest products, such as berries and firewood.

New, permanent road construction has markedly declined, and the current transportation system includes a backlog of maintenance needs. Currently, new road construction ranges from zero to 3 miles, reconstruction ranges from 5 to 35 miles, and decommissioning ranges from zero to 12 miles, all annually, for each of the three national forests. Roads are reconstructed for a number of purposes, including improving road conditions, driver safety, and fixing resource impacts. Road decommissioning occurs when a road is no longer needed for resource management and is minimally used by the public. Road decommissioning terminates motor vehicle use and restores ecological processes interrupted or impacted by the road. Roads are also decommissioned when maintenance requirements and resource impacts outweigh access needs.

Forest plans have components that guide decisions made to manage the transportation system on the three national forests. Those plan components include desired conditions for the road system, including desired conditions for open motor vehicle route density; suitability determinations for management areas where motor vehicle use is generally suitable or unsuitable; objectives for managing the transportation system to move towards achieving the desired conditions; and standards and guidelines to prevent environmental impacts when road maintenance, construction, or reconstruction is performed. Forest plans do not make decisions regarding individual roads or trails. This section includes discussion of the current transportation system on the three national forests, how the alternatives address the different plan components that would guide future management, and what the effects to access would be from implementing those plan components.

The Blue Mountains national forests trail system has remained relatively the same for the past 20 years. Currently, additional trail miles are rarely added to the trails system. Reconstruction of trails depends on funding and ranges from zero to 40 miles a year. Trail systems are rarely decommissioned.

Combining motor vehicle use and nonmotorized use at trailheads and along travel routes results in occasional conflicts, and contributes to access issues for each user group. As stated in the Recreation section, some trail maintenance issues have been resolved through project-level activities using American Recovery and Reinvestment Act funds. However, with the continuing shortage of allocated funds for trail maintenance, issues will continue to develop with limited funds to address them. There are relatively limited opportunities for motor vehicle use on system trails throughout the three national forests, a limitation that poses additional challenges considering this type of use is increasing both locally and regionally.

Trails used primarily for foot, pack or riding stock, and mechanized transportation have occasional conflicts between users. Trails for snowmobiles, Nordic skiers, snowshoers, and dog sleds are designated on existing National Forest System roads and contribute to the winter recreation opportunities offered within the national forests. The following table displays the distribution of opportunities across the three national forests. Recreation opportunities within the Hells Canyon National Recreation Area (Wallowa-Whitman National Forest) are not included in the following table.

**Table 7. Route and trail miles by type and season of use for each national forest (existing condition/1990 forest plans based on 2009 data)**

| National Forest | Motor Vehicle Use Routes (miles in winter) | Nonmotorized Use Routes (miles in winter) | Motor Vehicle Use Trails (miles in summer) | Nonmotorized Use Trails (miles in summer) |
|---|---|---|---|---|
| MAL | 771 | 55 | 37* | 465 |
| UMA | 139* | 31 | 464 | 1,246 |
| WAW | 896 | 80 | 138 | 860 |

* Used more current data to better reflect the existing condition.

Across the three national forests, trails are in a variety of management situations. In some locations, summer nonmotorized trails are in areas that allow only nonmotorized use (such as wilderness areas). In other places, summer nonmotorized trails are in an area that can also be managed for motor vehicle trails, in addition to roads and other uses. Winter recreation facilities and routes are frequently associated with road systems, so the nonmotorized winter routes are located in management areas that allow for motor vehicle use. Snowmobile routes are almost entirely on road systems, because the width of the route allows for grooming equipment to pass through. Snowmobilers may be using only the groomed routes because they prefer that kind of riding, or they may be using the routes to easily access areas where they like to ride cross country.

## Road Maintenance Levels

Road maintenance level (ML) is defined as the level of service provided by, and maintenance required for, a specific road, consistent with road management objectives and maintenance criteria (FSH 7709.58, Sec 12.3 - Transportation System Maintenance Handbook). The handbook serves as a primer for how the transportation system is managed and maintained. In general, road maintenance objectives are categorized into five levels designated ML1 to ML5. Each maintenance level and its associated characteristics and management strategy are described below.

**Maintenance Level 1 -** Assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed 1 year. Basic custodial maintenance is performed to keep damage to adjacent resource to an acceptable level and to perpetuate the road to facilitate future management activities. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Roads receiving level 1 maintenance may be of any type, class or construction standard, and may be managed at any other maintenance level during the time they are open for traffic. However, while being maintained at level 1, they are closed to vehicular traffic, but may be open and suitable for nonmotorized uses.

**Maintenance Level 2 -** Assigned to roads open for use by high clearance vehicles. Passenger car traffic is not a consideration. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Log haul may occur at this level.

**Maintenance Level 3 -** Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. Roads in this maintenance level are typically low speed, single lane with turnouts and spot surfacing. Some roads may be fully surfaced with either native or processed material.

**Maintenance Level 4 -** Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced. However, some roads may be single lane. Some roads may be paved and/or dust abated.

**Maintenance Level 5 -** Assigned to roads that provide a high degree of user comfort and convenience. Normally, roads are double-lane, paved facilities. Some may be aggregate surfaced and dust abated.

Roads may be currently maintained at one level and planned to be maintained at a different level at some future date. The operational maintenance level is the maintenance level currently assigned to a road considering today's needs, road condition, budget constraints, and environmental concerns.

### Key Indicators for Analyzing Access

- Road maintenance funds projected to be available to maintain the transportation system
    - ♦ Projected road maintenance for each road maintenance level (miles)
- National Forest System lands that would be suitable for motor vehicle route designation and use or suitable only for nonmotorized use (acres)
    - ♦ Change in acres suitable for summer motor vehicle route designation and use
    - ♦ Change in acres suitable only for summer nonmotorized use (where motor vehicle use would be prohibited)
    - ♦ Change in area suitable for winter over-the-snow motor vehicle use

## Environmental Consequences – Access

### Road Maintenance (Alternative A)

#### *Key Indicator*

- Road maintenance funds projected to be available to maintain the transportation system
    - ♦ Projected road maintenance for each road maintenance level (miles)

Maintenance of the transportation system is not sustainable given the current funding of the Forest Service. Table 8 indicates that the majority of the road maintenance budget is utilized on the double-lane passenger vehicle roads, which are the most expensive and most highly traveled portions of the road system. It is important to understand that some roads require annual maintenance while other roads, due to the stability of the roadbed, are rarely maintained. The figures are calculated using past maintenance and management costs, which fluctuated from year to year. When high clearance and closed roads receive maintenance on such an infrequent interval, deferred maintenance issues can become exacerbated. With the maintenance focus on maintenance levels (MLs) 3 through 5 roads, the deferred maintenance backlog for the remainder of the road system continues to grow. The cost of road maintenance and the budget trend make it likely that future road closures will be necessary.

**Table 8. Average annual road maintenance appropriated expenditures for the Blue Mountains national forests (existing condition/1990 forest plans)**

| Road Maintenance Level (ML) | Miles of Roads in Blue Mountains National Forests | Average Maintenance Interval (years) | Annual Road Maintenance Cost (per mile) | Average Annual Cost ($) |
|---|---|---|---|---|
| Double lane passenger vehicle roads (MLs 4 and 5) | 676 | 2 | $2,615 | $ 872,102 |
| Passenger vehicle roads (ML 3) | 714 | 3 | $1,607 | 383,001 |
| High clearance vehicle roads (ML 2) | 12,330 | 10 | $291 | 358,803 |
| Custodial care (closed roads) | 9,701 | 15 | $9 | 5,815 |
| **Totals** | **23,421** | **NA** | **NA** | **$1,474,454** |

The average allocated road maintenance budget from 2008 to 2010 is approximately $1.3 million for the three national forests. The annual shortfall is approximately 200,000 dollars, which adds to an already substantial deferred maintenance backlog. Given the priority of maintaining passenger vehicle roads, much of the deferred maintenance will fall on maintenance level 1 and 2 roads, which represent 93 percent of the road network. Many of these roads are decades old with aging infrastructure that may require partial or targeted reconstruction in order to meet hydrologic standards. The continued maintenance of an extensive road system creates many challenges. Roads in disrepair create safety issues and conflicts with resource protection goals. Wildlife, soil and water quality, and the spread of noxious weeds are negatively affected by the degree and public use of the transportation system. Road closures have only been moderately successful, with many road closures breached. The future road system will reflect how the Forest Service funds and supports road maintenance, reconstruction, and decommissioning efforts.

Road maintenance costs are not equal across the Blue Mountain national forests. A majority of Forest Service units within the broader region (Oregon and Washington) have phased out internal (Forest Service) maintenance capabilities, opting instead to complete maintenance activities through external contracting. While the majority of forests within the region have developed and adopted this structure, the Malheur National Forest has retained internal road maintenance capabilities through Forest Service road maintenance staffing and equipment, resulting in the potential for slightly lower road maintenance costs. The projected annual maintenance objectives vary within each forest for the action alternatives, reflecting the varying road maintenance structure for each forest.

**Table 9. Current maintenance levels and total miles of Forest Service roads for each national forest (existing condition/1990 forest plans based on 2009 data)**

| Road Maintenance Level (ML) | MAL | | UMA | | WAW | |
|---|---|---|---|---|---|---|
| | Miles | Percent | Miles | Percent | Miles | Percent |
| Custodial care (closed roads) | 2,856 | 30% | 2,447 | 53% | 4,398 | 49% |
| High clearance vehicle roads (ML 2) | 6,423 | 67% | 1,574 | 34% | 4,333 | 47% |
| Passenger vehicle roads (ML 3) | 54 | < 1% | 398 | 8% | 262 | 3% |
| Double lane passenger vehicle roads (MLs 4 and 5) | 318 | 3% | 232 | 5% | 126 | 1% |
| **Totals** | **9,651** | **100%** | **4,651** | **100%** | **9,119** | **100%** |

## Area Suitable for Summer Motor Vehicle Use (Alternative A)

### *Key Indicator*

- National Forest System lands that would be suitable for motor vehicle route designation and use or suitable only for nonmotorized use (acres)
  - ♦ Change in acres suitable for summer motor vehicle route designation and use

Access via roads and trails to and across the national forests has a long history in the Blue Mountains. Trails and migration routes date back to prehistoric times. American Indian migration routes are well documented through the stories of the Nez Perce, Umatilla, Warm Springs, and other tribes. Many of these ancient routes are the basis for roads, portions of roads, or trails that are in use today. Trails within the national forests also contributed to western migration as expeditions passed through this area in the 1800s. Notable ones include the original Oregon Trail, portions of which can be traced along its original alignment.

During the last 25 years, Forest Service project analyses have determined that many roads could be closed or decommissioned to improve resource conditions. Some benefits of these closures include reducing disturbances to wildlife, improving water quality, and reducing road maintenance costs.

In the 1990s, advancements in off-highway vehicle technology began to result in changes in use. Riders found that they could use off-highway vehicles to access rugged areas that had previously been accessible only by foot or horseback. This new type of use resulted in resource impacts, conflicts between user groups, and safety concerns.

The following table displays the amount of each national forest that is suitable for motor vehicle use in the 1990 forest plans.

**Table 10. Area suitable and available for motor vehicle use for each national forest (existing condition/1990 forest plans based on 2009 data)**

| National Forest | Acres Suitable for Motor Vehicle Use | Percent of National Forest |
|---|---|---|
| MAL | 1,428,050 acres | 84% |
| UMA | 934,240 acres | 67% |
| WAW | 1,315,750 acres | 75% |

## Area Suitable Only for Summer Nonmotorized Use (Alternative A)

### *Key Indicator*

- National Forest System lands that would be suitable for motor vehicle route designation and use or suitable only for nonmotorized use (acres)
    - ♦ Change in acres suitable only for summer nonmotorized use (where motor vehicle use would be prohibited)

Many trails on the national forests evolved from game trails, early American Indian hunting trails, and livestock herding trails, or those that were constructed by early recreation users. These trails were constructed to access remote lakes and scenic viewpoints. The majority of national forest trails are in dispersed and backcountry recreation areas.

National Forest System routes are extensively used by the public for a number of activities, so there is intense interest in having access continue in the way users have become accustomed to. The system was expensive to build and continues to have extensive annual cost for maintenance. With the expense of maintaining the system, budgets become a factor in what future road systems will look like. In addition, roads have created ecological impacts to fish and wildlife with sedimentation of streams, hydrologic interception, and disturbance to habitat, so there is constant pressure to reduce these negative effects of roads by limiting access, repairing heavy sediment sources, or removing the road all together.

**Table 11. Area suitable and available for nonmotorized use where motor vehicle use would be prohibited for each national forest (existing condition/1990 forest plans)**

| National Forest | Acres Suitable for Nonmotorized Vehicle Use | Percent of National Forest |
|---|---|---|
| MAL | 272,010 | 16% |
| UMA | 460,150 | 33% |
| WAW | 438,580 | 25% |

## Area Suitable for Winter Over-the-snow Motor Vehicle Use (Alternative A)

### *Key Indicator*

- National Forest System lands that would be suitable for motor vehicle route designation and use or suitable only for nonmotorized use (acres)
    - ♦ Change in area suitable for winter over-the snow motor vehicle use

This indicator reflects the potential level of change in acres suitable for motor vehicle use and the availability of areas where the sights and sounds of motors are not heard during the winter.

**Table 12. Area suitable for winter over-the-snow motor vehicle use for each national forest (existing condition/1990 forest plans)**

| National Forest | Acres Suitable for Winter Motor Vehicle Use | Percent of National Forest |
|---|---|---|
| MAL | 1,575,500 | 92% |
| UMA | 1,061,700 | 75% |
| WAW | 1,369,200 | 78% |

## Road Maintenance (Alternatives B, C, D, E, and F)

### *Key Indicator*

- Road maintenance funds projected to be available to maintain the transportation system
    - ♦ Projected road maintenance for each road maintenance level (miles)

### *Effects Common to Alternatives B, C, D, E, and F*

Access is a function of the area suitable for motor vehicle use, the season, and miles of roads and trails that are maintained and at what level, which will vary by funding levels for the alternatives. Access is also a function of what miles of open motor vehicle routes would be available to the public for recreation and driving while still meeting the open motor vehicle route density. The desired condition for open motor vehicle route density varies by alternative and depends on the themes of the alternatives.

The desired conditions, objectives, and budget levels are discussed in detail in appendix A.

### *Effects from Alternative B on Road Maintenance*

Based on the objectives for this alternative, table 13 displays the annual miles of road maintenance that are expected to occur during the first decade of the plan period for alternative B. Road maintenance is directly related to budget, and no change in the road maintenance budget is anticipated for this alternative. As a result, the expected maintenance levels are essentially the same as expected for alternative A.

It is also assumed that open motor vehicle route density desired conditions would be met by reclassifying maintenance level 2 roads to maintenance level 1 (custodial care) roads through individual project planning and decision making. These would become maintenance level 1 roads (custodial care), and while no road maintenance is expected for maintenance level 1 roads, standard practice indicates that areas with site-specific resource concerns would be treated as necessary.

The desired conditions, objectives, and budget levels are discussed in detail in appendix A.

**Table 13. Projected annual road maintenance and total miles of National Forest System roads for alternative B for each national forest**

| Road Maintenance Level (ML) | MAL Total Road Miles | MAL Miles Projected Annual Maintenance | UMA Total Road Miles | UMA Miles Projected Annual Maintenance | WAW Total Road Miles | WAW Miles Projected Annual Maintenance |
|---|---|---|---|---|---|---|
| Custodial care (closed roads) | 3,514 | 0 | 2,489 | 0 | 4,505 | 0 |
| High clearance vehicle roads (ML 2) | 5,765 | 900 | 1,532 | 110 | 4,225 | 218 |
| Passenger vehicle roads (ML 3) | 54 | 11 | 398 | 159 | 262 | 147 |
| Double lane passenger vehicle roads (MLs 4 and 5) | 318 | 225 | 232 | 158 | 126 | 79 |
| **Totals** | **9,651** | **1,136** | **4,651** | **427** | **9,118** | **444** |

### *Effects from Alternative C on Road Maintenance*

Based on the objectives for this alternative, table 14 displays the annual miles of road maintenance that are expected to occur during the first decade of the plan period for alternative C. The estimated cost to accomplish the project annual maintenance is compared to current funding levels, and the comparison is represented as a percentage. Based on this comparison, it is estimated that accomplishing maintenance objectives for alternative C would require funding levels to be 80 percent lower for the Malheur National Forest, 50 percent lower for the Umatilla National Forest, and 55 percent lower for the Wallowa-Whitman National Forest. These maintenance objectives would prioritize wildlife habitat and watershed restoration work.

**Table 14. Projected annual road maintenance and total miles of Forest Service roads for alternative C for each national forest**

| Road Maintenance Level (ML) | MAL Total Road Miles | MAL Miles Projected Annual Maintenance | UMA Total Road Miles | UMA Miles Projected Annual Maintenance | WAW Total Road Miles | WAW Miles Projected Annual Maintenance |
|---|---|---|---|---|---|---|
| Custodial care (closed roads) | 4,131 | 0 | 2,583 | 0 | 4,894 | 0 |
| High-clearance vehicle roads (ML 2) | 5,148 | 64 | 1,438 | 100 | 3,836 | 75 |
| Passenger vehicle roads (ML 3) | 54 | 11 | 398 | 79 | 262 | 79 |
| Double lane passenger vehicle roads (MLs 4 and 5) | 318 | 160 | 232 | 30 | 126 | 50 |
| **Totals** | **9,651** | **235** | **4,651** | **209** | **9,118** | **204** |

It is also assumed that open motor vehicle route density desired conditions would be met by reclassifying maintenance level 2 roads to maintenance level 1 (custodial care) roads through individual project planning and decision making. While no road maintenance is expected for maintenance level 1 roads, standard practice indicates that areas with site-specific resource concerns would be treated as necessary. These reductions in open motor vehicle routes would result in distribution of maintenance over a considerably smaller transportation system.

The desired conditions, objectives, and budget levels are discussed in detail in appendix A.

### *Effects from Alternative D on Road Maintenance*

Based on the objectives for this alternative, table 15 displays the annual miles of road maintenance that are expected to occur during the first decade of the plan period for alternative D. The estimated cost to accomplish the projected annual maintenance is compared to current funding levels and is represented as a percentage. Based on this comparison, it is estimated that accomplishing annual maintenance objectives for alternative D would require annual funding levels to be 40 percent higher for the Malheur National Forest, 115 percent higher for the Umatilla National Forest, and 60 percent higher for the Wallowa-Whitman National Forest. These maintenance objectives would allow greater public access and ensure that roads necessary to accomplish vegetation treatments are available.

It is also assumed that open motor vehicle route density desired conditions would be met by reclassifying maintenance level 2 roads to maintenance level 1 (custodial care) roads through individual project planning and decision making. While no road maintenance is expected for maintenance level 1 roads, standard practice indicates that areas with site-specific resource concerns would be treated as necessary.

The desired conditions, objectives, and budget levels are discussed in detail in appendix A.

**Table 15. Projected annual road maintenance and total miles of Forest Service roads for alternative D for each national forest**

| Road Maintenance Level (ML) | MAL Total Road Miles | MAL Miles Projected Annual Maintenance | UMA Total Road Miles | UMA Miles Projected Annual Maintenance | WAW Total Road Miles | WAW Miles Projected Annual Maintenance |
|---|---|---|---|---|---|---|
| Custodial care (closed roads) | 2,862 | 0 | 2,448 | 0 | 4,406 | 0 |
| High clearance vehicle roads (ML 2) | 6,418 | 1,280 | 1,573 | 400 | 4,325 | 400 |
| Passenger vehicle roads (ML 3) | 54 | 44 | 398 | 300 | 262 | 200 |
| Double lane passenger vehicle roads (MLs 4 and 5) | 318 | 280 | 232 | 210 | 126 | 100 |
| **Totals** | **9,651** | **1,604** | **4,651** | **910** | **9,118** | **700** |

### *Effects from Alternative E on Road Maintenance*

Based on the objectives for this alternative, table 16 displays the annual miles of road maintenance that are expected to occur during the first decade of the plan period for alternative E. The estimated cost to accomplish the projected annual maintenance is compared to current funding levels and is represented as a percentage. Based on this comparison, it is estimated that accomplishing annual maintenance objectives for alternative E would require annual funding levels to be 15 percent higher for the Malheur National Forest, 25 percent higher for the Umatilla National Forest, and 20 percent lower for the Wallowa-Whitman National Forest.

These maintenance objectives would provide the Forest Service with the ability to address soils, hydrologic, and wildlife habitat concerns in addition to providing public access and access for vegetation treatments and fuels reductions activities.

It is also assumed that open motor vehicle route density desired conditions would be met by reclassifying maintenance level 2 roads to maintenance level 1 (custodial care) roads through individual project planning and decision making. While no road maintenance is expected for maintenance level 1 roads, standard practice indicates that areas with site-specific resource concerns would be treated as necessary.

The desired conditions, objectives, and budget levels are discussed in detail in appendix A.

**Table 16. Projected annual road maintenance and total miles of Forest Service roads for alternative E for each national forest**

| Road Maintenance Level (ML) | MAL Total Road Miles | MAL Miles Projected Annual Maintenance | UMA Total Road Miles | UMA Miles Projected Annual Maintenance | WAW Total Road Miles | WAW Miles Projected Annual Maintenance |
|---|---|---|---|---|---|---|
| Custodial care (closed roads) | 3,524 | 0 | 2,585 | 0 | 4,553 | 0 |
| High clearance vehicle roads (ML 2) | 5,755 | 1,025 | 1,505 | 140 | 4,177 | 110 |
| Passenger vehicle roads (ML 3) | 54 | 38 | 398 | 200 | 262 | 159 |
| Double lane passenger vehicle roads (MLs 4 and 5) | 318 | 250 | 232 | 200 | 126 | 90 |
| **Totals** | **9,651** | **1,313** | **4,651** | **540** | **9,118** | **359** |

### *Effects from Alternative F on Road Maintenance*

Based on the objectives for this alternative, table 17 displays the annual miles of road maintenance that are expected to occur during the first decade of the plan period for alternative F. The estimated cost to accomplish the projected annual maintenance is compared to current funding levels and is represented as a percentage. Based on this comparison, it is estimated that accomplishing annual maintenance objectives for alternative F would require annual funding levels to be 15 percent higher for the Malheur National Forest, 25 percent higher for the Umatilla National Forest, and 20 percent lower for the Wallowa-Whitman National Forest.

These maintenance objectives would provide the Forest Service with the ability to address soils, hydrologic, and wildlife habitat concerns.

**Table 17. Projected annual road maintenance and total miles of Forest Service roads for alternative F for each national forest**

| Road Maintenance Level (ML) | MAL Total Road Miles | MAL Miles Projected Annual Maintenance | UMA Total Road Miles | UMA Miles Projected Annual Maintenance | WAW Total Road Miles | WAW Miles Projected Annual Maintenance |
|---|---|---|---|---|---|---|
| Custodial care (closed roads) | 2,984 | 0 | 2,516 | 0 | 4,496 | 0 |
| High clearance vehicle roads (ML 2) | 6,395 | 1,000 | 1,505 | 125 | 4,233 | 100 |
| Passenger vehicle roads (ML 3) | 54 | 32 | 398 | 190 | 262 | 149 |
| Double lane passenger vehicle roads (MLs 4 and 5) | 318 | 250 | 232 | 200 | 126 | 90 |
| **Totals** | **9,651** | **1,313** | **4,651** | **540** | **9,119** | **359** |

It is also assumed that open motor vehicle route density desired conditions would be met by reclassifying maintenance level 2 roads to maintenance 1 (custodial care) roads through individual project planning and decision making. While no road maintenance is expected for maintenance level 1 roads, standard practice indicates that areas with site-specific resource concerns would be treated as necessary.

The desired conditions, objectives, and budget levels are discussed in detail in appendix A.

## Area Suitable for Summer Motor Vehicle Use and Areas Suitable Only for Summer Nonmotorized Use (Alternatives B, C, D, E, and F)

### *Key Indicator*

- National Forest System lands that would be suitable for motor vehicle route designation and use or suitable only for nonmotorized use (acres)
    - Change in acres suitable for summer motor vehicle route designation and use
    - Change in acres suitable only for summer nonmotorized use (where motor vehicle use would be prohibited)

### *Effects Common to Alternatives B, C, D, E, and F*

Access is also represented by trail routes that are accessed by either motor vehicle means, such as OHVs or motorcycles, or by nonmotorized means, such as horses, bikes, or foot travel. Because alternatives vary the acres that are generally suitable for motor vehicle or nonmotorized use vary with each alternative, the trail system distribution would vary within these areas. The desired conditions, objectives, and budget levels are discussed in detail in appendix A.

For some alternatives, management direction for areas that currently are unsuitable for motor vehicle use may change to suitable for motor vehicle use. Nonmotorized trails in these areas would continue to be nonmotorized unless a subsequent site-specific decision is made to change the type of use. Users of those trails can expect the same experience they currently have, at least in the short term, especially since cross-country motor vehicle travel is unsuitable in any area in any alternative. However, future project planning and decision making may allow for increased motor vehicle access in those areas, resulting in potential impacts to nonmotorized users (e.g., seeing and hearing motor vehicles).

The following table displays the acres suitable for summer and winter motor vehicle use for each national forest in each alternative.

**Table 18. Acres suitable for summer and winter use of motor vehicle routes by alternative for each national forest**

| National Forest | Summer Acres | | | | |
|---|---|---|---|---|---|
| | Alternative A | Alternative B | Alternative C | Alternative D | Alternatives E and F |
| MAL | 1,428,050 | 1,533,000 | 876,000 | 1,591,500 | 1,543,500 |
| UMA | 934,200 | 1,004,000 | 507,000 | 1,019,100 | 884,600 |
| WAW | 1,315,800 | 1,289,000 | 606,000 | 1,305,100 | 1,182,500 |
| **National Forest** | **Winter Acres** | | | | |
| | **Alternative A** | **Alternative B** | **Alternative C** | **Alternative D** | **Alternatives E and F** |
| MAL | 1,575,500 | 1,534,000 | 1,094,800 | 1,616,700 | 1,563,100 |
| UMA | 1,061,700 | 1,005,000 | 650,300 | 1,096,300 | 990,800 |
| WAW | 1,369,200 | 1,300,000 | 703,800 | 1,331,500 | 1,227,100 |

### *Effects from Alternative B on Areas Suitable for Motor Vehicle Route Designation and Use and Areas Suitable Only for Nonmotorized Use*

For this alternative, management areas would be allocated differently than in the 1990 forest plans. See the description of the alternatives in chapter 2. Due to the change in management area allocations, there would be a change in the number of acres suitable for motor vehicle use, both in summer and in winter.

**Table 19. Change in acres suitable for summer motor vehicle use and summer nonmotorized use* for alternative B for each national forest**

| National Forest | Acres Suitable for Summer Motor Vehicle Routes | Change in Acres Suitable for Motor Vehicle Summer Routes (from existing condition) | Change in Acres Suitable for Nonmotorized Summer Use* (from existing condition) |
|---|---|---|---|
| MAL | 1,533,000 (90%) | 7% increase | 39% decrease |
| UMA | 1,004,000 (71%) | 7% increase | 14% decrease |
| WAW | 1,289,000 (73%) | 2% decrease | 6% decrease |

* Nonmotorized use areas where motor vehicle use would be prohibited.

Within the Malheur National Forest, there would be a slight increase in acres suitable for summer motor vehicle use and a large decrease in acres suitable only for summer nonmotorized use. This is due to most of MA 4C Old Forest in the 1990 forest plan being suitable only for nonmotorized use. MA 4C generally consists of small areas intermixed with MA 4A General Forest/Timber/Range. In this alternative, those small areas would be reallocated to MA 4A. See the section on “Old Forest” for more information. The change would be large relative to the management area allocations, but the overall change in acres would be relatively small. Since cross-country travel would be prohibited and current MA 4C areas are unroaded, the effect of changing this allocation from suitable only for nonmotorized use to suitable for motor vehicle use would be minimal.

Within the Umatilla National Forest, there would be a slight increase in area suitable for motor vehicle use in the summer due to the same reallocation of MA 4C to MA 4A discussed for the Malheur National Forest. The amount of area allocated to MA 3B Backcountry (limited motor vehicle use) would increase in this alternative due to additions from MA 4A.

Within the Wallowa-Whitman National Forest, there would be a very slight decrease in area suitable for summer motor vehicle use, which would be due to the addition of MA 1B Preliminary Administratively Recommended Wilderness Areas. The 11 percent decrease in area suitable only for summer nonmotorized use would be due to the reallocation of MA 4C to MA 4A.

### *Effects from Alternative C on Areas Suitable for Motor Vehicle Route Designation and Use and Areas Suitable Only for Nonmotorized Use*

For this alternative, management area allocations would depart from those presented in the 1990 forest plans. The alternatives are described in chapter 2, and the tables displaying acres by management area are in appendix A. The change in management area allocations would result in a change in acres suitable for motor vehicle use, both in summer and in winter (table 20).

This alternative emphasizes increased suitability for nonmotorized uses and low open motor vehicle route density in areas suitable for motor vehicle use. Alternative C presents the largest increase in acres allocated to MA 3A Backcountry (nonmotorized use), from 76,000 acres in the existing condition to 630,000 acres for all three national forests. This eight-fold increase would affect motor vehicle routes and trails in areas that were previously suitable for motor vehicle use. Over time, this would reduce the trails and roads suitable for motor vehicle use. This alternative would not allocate any area to MA 3B Backcountry (limited motor vehicle use). Similarly, alternative C allocates more acres to MA 3C Wildlife Corridors compared to alternatives E and F. Alternatives B and D do not assign any acreage to this management area. MA 3C areas are designed to provide wildlife corridors to connect habitat, and the desired condition for open route density in this management area would be 1 mile per square mile.

**Table 20. Change in acres suitable for summer motor vehicle use and summer nonmotorized use* for alternative C for each national forest**

| National Forest | Acres Suitable for Summer Motor Vehicle Routes | Change in Acres Suitable for Motor Vehicle Summer Routes (from existing condition) | Change in Acres Suitable for Nonmotorized Summer Use* (from existing condition) |
|---|---|---|---|
| MAL | 876,000 (52%) | 38% decrease | 203% increase |
| UMA | 507,000 (36%) | 46% decrease | 94% increase |
| WAW | 605,600 (35%) | 54% decrease | 162% increase |

* Nonmotorized use areas where motor vehicle use would be prohibited.

Management areas that contribute to a reduction in acres suitable for motor vehicle use would also be unsuitable for winter motor vehicle use on both routes and trails and for cross country travel. MAs 1A, 1B, 1C, 2B, 2I, and 3A would not be suitable for winter motor vehicle use. MA 3C would be suitable for over-the-snow motor vehicle use only on groomed trails (cross-country travel would not be allowed). The groomed winter trail system in MA 3C would not be allowed to exceed the summer open motor vehicle route density, which would be 1 mile per square mile.

### *Effects from Alternative D on Areas Suitable for Motor Vehicle Route Designation and Use and Area Suitable Only for Nonmotorized Use*

Alternative D emphasizes maintaining or expanding the current amount of acres suitable for motor vehicle. This alternative would not allocate any National Forest System lands to MA 1B Preliminary Administratively Recommended Wilderness Areas or MA 3A Backcountry (nonmotorized use).

**Table 21. Change in acres suitable for summer motor vehicle use and summer nonmotorized use* for alternative D for each national forest**

| National Forest | Acres Suitable for Summer Motor Vehicle Routes | Change in Acres Suitable for Motor Vehicle Summer Routes (from existing condition) | Change in Acres Suitable for Nonmotorized Summer Use* (from existing condition) |
|---|---|---|---|
| MAL | 1,591,500 (94%) | 11% increase | 60% decrease |
| UMA | 1,019,100 (73%) | 9% increase | 17% decrease |
| WAW | 1,305,100 (74%) | 1% decrease | 3% decrease |

* Nonmotorized use areas where motor vehicle use would be prohibited.

For alternative D, only MAs 1A, 2B, and 2I would not be suitable for winter motor vehicle use. The intent of this alternative is to minimize effects to motor vehicle use. Therefore, only the management areas where motor vehicle use would be prohibited by law or by research would be unsuitable for winter motor vehicle use.

#### *Effects from Alternatives E and F on Areas Suitable for Motor Vehicle Route Designation and Use and Areas Suitable Only for Nonmotorized Use*

Approximately 91,000 acres would be allocated to MA 1B Preliminary Administratively Recommended Wilderness Areas. This would contribute to the change in acres suitable for motor vehicle use displayed in table 20 and table 21. Alternatives E and F allocate less acres to MA 3C Wildlife Corridors compared to alternatives C. Alternatives B and D do not assign any acreage to this management area. MA 3C areas are designed to provide wildlife corridors to connect habitat, and the desired condition for open route density in this management area would be 1 mile per square mile.

**Table 22. Change in acres suitable for summer motor vehicle use and summer nonmotorized use* for alternatives E and F for each national forest**

| National Forest | Acres Suitable for Summer Motor Vehicle Routes | Change in Acres Suitable for Motor Vehicle Summer Routes (from existing condition) | Change in Acres Suitable for Nonmotorized Summer Use* (from existing condition) |
|---|---|---|---|
| MAL | 1,543,500 (91%) | 8% increase | 42% decrease |
| UMA | 884,600 (63%) | 5% decrease | 12% increase |
| WAW | 1,182,500 (67%) | 10% decrease | 30% increase |

* Nonmotorized use areas where motor vehicle use would be prohibited.

For alternatives E and F, MAs 1A, 2B, 2I, and 3A would be unsuitable for motor vehicles. There would be a slight reduction in winter motor vehicle access for all national forests.

### Area Suitable for Winter Over-the-snow Motor Vehicle Use (Alternatives B, C, D, E, and F)

#### *Key Indicator*

- National Forest System lands that would be suitable for motor vehicle route designation and use or suitable only for nonmotorized use (acres)
    - ♦ Change in area suitable for winter over-the-snow motor vehicle use

#### *Effects Common to Alternatives B, C, D, E, and F*

There would be no desired conditions, standards, or guidelines for over-the-snow travel. Management direction for over-the-snow travel is provided by Code of Federal Regulations and site specific project decisions.

#### *Effects from Alternative B on Areas Suitable for Over-the-snow Motor Vehicle Use*

All three national forests would have very slight changes in acres suitable for winter motor vehicle use in this alternative. MA 3A would be slightly larger for this alternative in some locations, which would restrict winter motor vehicle use. The percent of the national forests available for winter motor vehicle use would change only minimally from the existing condition. The changes are due to minor adjustments in management area allocations.

**Table 23. Acres suitable for over-the-snow motor vehicle use for alternative B for each national forest**

| National Forest | MAs Suitable for Winter Motor Vehicle Use | Acres Suitable for Winter Motor Vehicle Use | Percent Change from Existing Condition |
|---|---|---|---|
| MAL | MAs 1B, 3B, 4A, 4B, and 5 | 1,534,000 (90%) | 3% decrease |
| UMA | | 1,005,000 (72%) | 5% increase |
| WAW | | 1,300,000 (74%) | 5% decrease |

### *Effects from Alternative C on Areas Suitable for Over-the-snow Motor Vehicle Use*

All three national forests would have large changes in acres suitable for winter motor vehicle use in this alternative. All of the acres allocated to back country management area designation would be allocated to MA 3A which restricts winter motor vehicle use. Winter motor vehicle use would be suitable in MAs 4A and 5. In addition, MA 1B would be closed to over-the-snow motor vehicle use in this alternative, as show in the general suitability matrix in appendix A. This alternative would have the greatest change in the availability of snow play areas of all alternatives, in addition to potential effect to the groomed snowmobile routes that travel through MA 3C, as additional route restrictions may occur to meet route density standards in the summer. Future project level planning and decision making would be conducted to determine if any closed summer routes would also be closed in winter.

**Table 24. Acres suitable for over-the-snow motor vehicle use for alternative C for each national forest**

| National Forest | MAs Suitable for Winter Motor Vehicle Use | Acres Suitable for Winter Motor Vehicle Use | Percent Change from Existing Condition |
|---|---|---|---|
| MAL | MAs 4A, 4B, 4C, and 5 | 1,094,800 (64%) | -30% |
| UMA | | 650,300 (46%) | -39% |
| WAW | | 703,800 (40%) | -49% |

### *Effects from Alternative D on Areas Suitable for Over-the-snow Motor Vehicle Use*

For alternative D, only slight changes in acres suitable for winter motor vehicle use would occur, which would include increases in the total acres for the Umatilla and Malheur National Forests. There would be no allocations to MA 3A where winter motor vehicle use would be restricted for the other alternatives. In addition, there would be no allocations to MA 1B. Winter motor vehicle use would be suitable in MAs 3B, 4A, 4B, and 5.

**Table 25. Acres suitable for over-the-snow motor vehicle use for alternative D for each national forest**

| National Forest | MAs Suitable for Winter Motor Vehicle Use | Acres Suitable for Winter Motor Vehicle Use | Percent Change from Existing Condition |
|---|---|---|---|
| MAL | MAs 3B, 4A, 4B, and 5 | 1,616,700 (95%) | +3% |
| UMA | | 1,096,300 (78%) | +3% |
| WAW | | 1,331,500 (76%) | -3% |

### *Effects from Alternative E and F on Areas Suitable for Over-the-snow Motor Vehicle Use*

All three national forests would have slight changes in acres suitable for winter motor vehicle use in this alternative. MA 3A would be slightly in this alternative in some locations, which would restrict winter motor vehicle use. Winter motor vehicle use would be suitable in MAs 1B, 3B, 4A, 4B, and 5, much like alternative B. Over-the-snow motor vehicle would still be allowed in MA 1B, as displayed in the suitability table in appendix A.

**Table 26. Change in acres suitable for winter motor vehicle use by national forest for alternatives E and F for each national forest**

| National Forest | MAs Suitable for Winter Motor Vehicle Use | Acres Suitable for Winter Motor Vehicle Use | Percent Change from Existing Condition |
|---|---|---|---|
| MAL | MAs 1B, 3B,4A,4B, and 5 | 1,563,100 (92%) | -1% |
| UMA | | 990,800 (71%) | -7% |
| WAW | | 1,227,100 (70%) | -10% |

## Cumulative Effects – Access

Implementation of all alternatives, except for alternative A for the Umatilla National Forest, would affect access over time. In every other alternative, open motor vehicle route density would exceed desired conditions, which makes it likely that site-specific project level decisions would result in road closure or decommissioning as the Forest Service attempts to achieve or move toward the desired conditions.

Proposed open route densities for all alternatives are meant to be an upper limit, and all alternatives have many areas that would have open routes at a level that is far below the proposed upper limits. It is not the intent of the plan to increase open route density to that upper limit. Rather, in areas that currently have open route density above the level proposed by desired conditions, it is expected that open routes would be closed as project level decisions are made and implemented throughout the plan period. All alternatives, except alternative A for the Umatilla National Forest, propose management direction that would result in the closure or decommissioning of open motor vehicle routes in order to meet desired conditions. Minimal new road construction would occur for all alternatives.

Road reconstruction would emphasize user safety and prevention or correction of resource impacts. If maintenance funding decreases, roads determined to be unsafe and of low priority for maintenance would likely have to be closed, and the trend of reductions in road maintenance funds is likely to continue. Current trail maintenance levels would continue.

The cumulative effects analysis area for access is defined by the county boundaries for the counties within the planning area, which are Baker, Grant, Harney, Morrow, Umatilla, Union, Wallowa, and Wheeler counties in Oregon and Asotin, Columbia, and Garfield counties in Washington. This cumulative effects area is used because local communities and visitors to the area are generally looking for a type of motor vehicle or nonmotorized use that can occur on public or private lands, but normally would not occur outside of the county boundary.

Within the cumulative effects area, National Forest System lands, Bureau of Land Management lands, state lands, industrial timber lands, and other private lands are available for public access. The trend on these lands has been for more restrictions on motor vehicle uses. The Baker Field Office for the Bureau of Land Management released a Draft Resource Management Plan (USDI 2011) that describes the existing condition to be an array of roads that are currently open, and much of the surrounding lands are open for cross-country motor vehicle travel. The draft plan states that a travel management plan to designate open routes would be completed within five years of signing the record of decision for the Final Resource Management Plan. However, the draft plan does propose interim direction to designate areas as open to cross country motor vehicle travel, limited to existing routes and trails, or closed to cross country motor vehicle travel. Alternative E designates only one existing off-highway vehicle area as open to cross country motorized travel, identifies several areas closed to cross-country motor vehicle travel, and designates the remaining areas as limited to existing roads and trails. Analyses of the management situation for other BLM lands within the analysis area associated with the southeast Oregon area and the John Day River Basin have identified a need to address unrestricted motor vehicle use. Completion of resource management plans and travel management plans for these areas will likely lead to future reductions of motor vehicle use opportunities.

On state, industrial timber lands, and other private lands, the trend for motor vehicle use is not evident because it is specific to the managing state agency, timber land owner, or private owner.

The cumulative effect of reduced motor vehicle access on Bureau of Land Management lands in conjunction with the action alternatives proposed for this DEIS is to intensify the adverse effect experienced by those who desire more motor vehicle access and intensify the beneficial effect experienced by those who desire less motor vehicle access. The opportunity to displace motor vehicle access from the national forests to other jurisdictions or ownerships would not be available under expected trends.

# Issue 2: Economic and Social Well-being

## Introduction and Purpose

Forest plan decisions create the framework for the range of uses, and products and services provided by the Blue Mountains national forests that contribute to the economic and social well-being of local communities, counties, and tribes. Forest products and services support the maintenance of local business infrastructure. The infrastructure, in turn, plays a critical role supporting and enhancing the Forest Service's capacity to conduct management activities. People are a part of the ecosystem and are essential to the vitality and resiliency of the ecosystem. They are the stewards, producers, distributors, and users whose actions and activities shape Forest Service policy and management.

This section provides existing condition and trend data for the key indicators related to the social and economic environment. The data provide a backdrop to facilitate evaluating and understanding how the alternatives address social and economic issues. These issues may be affected by management actions that would be guided by the forest plan alternatives. The issues also influence the design of the alternatives.

## Relationships, Social and Economic Well-being, and Resilience

Changes in national forest management can affect traditions, lifestyles, and the economic livelihood of residents and communities. Those who depend on the national forests for their livelihoods and recreational pursuits are concerned that their relationship with the national forests may be compromised by other uses and restrictions. Forest Service managers depend on their relationships with local communities, people, and their institutions to help manage the national forests by providing a skilled workforce, labor, manufacturing infrastructure, business support, and other services cost effectively. All of these relationships are important to sustaining and restoring the ecological integrity of the national forests as well as the social and economic conditions of the communities.

Factors that appear to help make communities resilient to economic and social change include population size and rates of change; economic, social, and cultural diversity; amenity settings; and quality of life. Communities with larger populations tend to have a broader array of industries and a higher number of businesses that function in each industry. More diversified economies do not depend heavily on any single industry or firm. When industries decline and jobs are lost, communities with greater economic diversity are better able to absorb the losses. Forest Service land use decisions often have few economic impacts on communities with large populations and diverse economies.

In contrast, communities with small populations usually have fewer industries and fewer businesses within those industries. A decline in one industry or loss of a business, especially a major employer, can result in job losses that affect many aspects of community life. Job losses can be especially disruptive if the community is geographically isolated with few alternative employment opportunities.

The three Blue Mountains national forests, though similar ecologically, exhibit sharp contrasts in community resiliency, and the communities may be affected differently by changes in national forest management. The following sections describe some of the social and economic characteristics that distinguish the areas affected by the three national forests.

## Affected Environment – Economic and Social Well-being

This section describes the existing conditions as they relate to the social and economic components of the areas that may be affected by the plan revision for the Malheur, Umatilla, and Wallowa-Whitman National Forests. The following discussion identifies the economic and social systems in place within the communities surrounding the three national forests and the people using and valuing the natural resources and opportunities the national forests provide.

### Population and Demographics

Population structural characteristics, such as size, composition, density, age, race, and ethnicity, along with population dynamics showing how the structure changes over time, are useful to describe the potential need for different types and amounts of national forest uses. The characteristics can be helpful to focus the potential effects and consequences of proposed activities on the social environment.

Increases in population can result in increased demands on existing uses and services, such as demands for additional access and recreation opportunities. When the population increase is primarily through in-migration, it can result in desires for a different mix of management activities and uses resulting in potential incompatibilities between people with differing values. An increase in users can result in conflicts even among people with similar values where crowding occurs.

### Population Size, Growth, and Density

One of the important variables describing the resiliency of a community is the size of the population and the positive or negative rate the population is changing. Population trends show how the overall numbers of residents have varied in the past and indicate what the population level may be in the future. These numbers help to show whether there is the potential for a change in demands for uses and products and services. Population change may lead to conflicts about the types of national forest uses, travel management, recreation activities, and opinions about the appropriateness of resource management activities.

The population size, growth, and density in each of the socio-economic impact zones for the three national forests are markedly different. With a density of about one person per square mile (Census 2000), the population within the Malheur socio-economic impact zone is small compared to the other socio-economic impact zones. The Oregon statewide density was 15 people per square mile (Census 2000). In addition, the population in Grant and Harney counties has declined between 2000 and 2009 (table 27) by 13 percent, or almost 2,000 residents (Census 2010).

**Table 27. Population change 2000-09 by county in the Malheur socio-economic impact zone**

| County | Change in Population |
|---|---|
| Grant | -14% (-1,108) |
| Harney | -11% (-873) |
| Total Change | -13% (-1,981) |

In the Umatilla socio-economic impact zone, the population overall has increased by 8,240, or about three percent (table 28). The change at the individual county level is more complex. Three counties within the socio-economic impact zone, Grant, Wheeler, and Garfield, lost more than 10 percent of their population and Wallowa County declined by five percent. Most of the population gain between 2000 and 2009 was in Umatilla County in Oregon, Nez Perce County in Idaho, and Walla Walla County in Washington. The decadal growth increases were generally five percent or less, except for Walla Walla County, which grew by seven percent. Although the Umatilla socio-economic impact zone grew the most, the overall growth was much less than the Oregon statewide growth during the same time period (15 percent). The Umatilla socio-economic impact zone is the most densely populated with about 11 people per square mile, four less than the Oregon statewide average. Nez Perce and Walla Walla counties have the highest population densities in the socio-economic impact zone with about 44 people per square mile, and Wheeler County has the lowest density with less than one person per square mile.

The Wallowa-Whitman socio-economic impact zone decreased overall by one percent between 2000 and 2009, or slightly less than 500 people (table 29). Both Baker and Wallowa counties decreased by four and five percent respectively, and Union County increased by two percent. The population density of this socio-economic impact zone is six people per square mile (Census 2010).

The population density data for all three socio-economic impact zones are lower than the density for Oregon. The low density rates emphasize the rural nature, especially of the Malheur and Wallowa-Whitman socio-economic impact zones, compared to the Oregon state average. Residents living in all socio-economic impact zones value the open space, personal independence, rural lifestyle, and the minimal crowding offered by a low population density. With the low population growth exhibited during the last decade, these conditions and values are likely to persist.

**Table 28. Population change 2000-09 by county in the Umatilla socio-economic impact zone**

| County | Change in Population |
|---|---|
| Grant | -14% (-1,108) |
| Morrow | 5% (+509) |
| Umatilla | 4% (+2,647) |
| Union | 2% (+494) |
| Wallowa | -5% (-326) |
| Wheeler | -12% (-180) |
| Nez Perce | 5% (+1,814) |
| Asotin | 4% (+877) |
| Columbia | -1% (-31) |
| Garfield | -12% (-288) |
| Walla Walla | 7% (+3,832) |
| Total Change | 3% (+8,240) |

**Table 29. Population change 2000-09 by county in the Wallowa-Whitman socio-economic impact zone**

| County | Change in Population |
|---|---|
| Baker | -4% (-635) |
| Union | 2% (+494) |
| Wallowa | -5% (-326) |
| Total Change | -1% (-467) |

## Age

In the United States, the aging of the population may result in impacts to the national forests, especially travel and access. The impact of retirement-aged people on communities can be complex, but can include bringing in additional sources of income, and opinions about and the desire for different types of recreational activities and access needs.

Between 2000 and 2009, the median age in the Malheur socio-economic impact zone increased from about 41 to 48 years old. This change in median age is reflected in the declines within the portion of the population that are less than 65 years old and the increase of people that are 65 years old and older. In 2000, the less than 18 years old group comprised 26 percent of the total population. Ten years later, this portion of the population comprised 21 percent. Conversely, those people 65 years and older increased from 16 percent to 21 percent of the population. This change was in part due to an increase in people in this age class but also because the other classes decreased. Although the working years class (18 through 64 years old) declined, the portion of the total population remained constant at 58 percent of the total (Census 2010).

The age data in the Umatilla socio-economic impact zone portray a different picture than that found within the Malheur socio-economic impact zone. While the Umatilla socio-economic impact zone is aging, the rate of change is less. The median age increased from 37 to 40 years old but remains substantially younger compared to the Malheur socio-economic impact zone. The less than 18 years old group decreased by five percent, and its overall portion of the total decreased from 26 percent to 24 percent. The working ages class (18 through 64 years old) increased by five percent and continued to make up about 60 percent of the total population.

Those 65 years old and older increased by 12 percent, and now make up 16 percent of the total population, one percent more than in 2000 (Census 2010).

The Wallowa-Whitman socio-economic impact zone has also aged. The median age in 2009 was about 44 years old compared to 41 in 2000. The working age class (18 through 64 years old) remained unchanged between 2000 and 2009, and continues to make up about 59 percent of the total population. The less than 18 years old group decreased by 13 percent, and they now make up 21 percent of the population compared to almost 24 percent in 2000. The 65 years old and older group increased by 13 percent and now make up 19 percent of the total population compared to 17 percent in 2000 (Census 2010).

### Gender, Race, and Ethnicity

Annual data estimates for the number of people in the Malheur and Umatilla socio-economic impact zones during 2000 through 2009 show that the male and female components of the population are evenly split. The Wallowa-Whitman socio-economic impact zone is split fairly even with 49 percent of the population male and 51 percent female. At about age 75, women make up more than 55 percent of the population (Census 2010).

Race and ethnic diversity is increasing gradually in the three socio-economic impact zones. From 2000 to 2009, the white, not Hispanic or Latino population for the Malheur socio-economic impact zone decreased from 92 to 90 percent of the total population, or a decrease of about 2,100 people. The white, not Hispanic or Latino population was the only component of the population that decreased. The rest of the race and ethnic components remained the same or increased. The largest components of the minority population include American Indian, two or more races, and Hispanics of any race (Census 2010).

In the Umatilla socio-economic impact zone, the white, not Hispanic or Latino population decreased by about 1,900 people between 2000 and 2009, decreasing from 84 to 81 percent of the total population. Hispanic or Latino of any race increased by 7,500 people, and the two or more races category increased by about 1,000 people. The remaining races increased by 190 to 740 people (Census 2010).

Within the Wallowa-Whitman socio-economic impact zone, the pattern continued, as the white not Hispanic or Latino population decreased by about 1,600 between 2000 and 2009. From 94 to 93 percent of the total population. The Hispanic or Latino of any race category population increased by about 540 people, and the two or more race population increased by about 240 people. The remaining race category populations all increased, as well (Census 2010).

The three socio-economic impact zones in the plan revision area are becoming more diverse with the in-migration of minorities and Hispanics or Latinos, and, because of the out migration of white, not Hispanic or Latino people. The increase in diversity is important because new and potentially different views on natural resource management activities may be present, and desired uses and services, such as recreational activities and special forest products, may change.

Evaluating the minority components of the population is also important because Executive Order 12898 requires all Federal agencies to analyze the potential for their actions to disproportionately affect minority and low-income populations. The Council on Environmental Quality issued supplemental guidance and provided the following criteria for identifying potential environmental justice populations:

> Minority population: Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis…
>
> Low-income population: Low-income populations in an affected area should be identified with the annual statistical poverty thresholds from the Bureau of the Census' Current Population Reports, Series P-60 on Income and Poverty. In identifying low-income populations, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect.

The minority and ethnic populations of the three socio-economic impact zones are compared with the state of Oregon in table 30. The state is used as an appropriate unit of geographic analysis to represent a general population. Based on this comparison, Hispanics of any race in the Umatilla socio-economic impact zone make up a larger portion of the population than statewide. American Indians and Alaska Natives make up a larger portion of the population in both the Umatilla and Malheur socio-economic impact zones than statewide.

**Table 30. Race and ethnicity comparisons for Oregon and the socio-economic impact zones, 2009**

| Race or Ethnicity | Oregon | Socio-economic Impact Zone | | |
|---|---|---|---|---|
| | | Malheur | Umatilla | Wallowa-Whitman |
| Hispanic or Latino | 11% | 4% | 13% | 3.5% |
| Two or more races | 3% | 2.5% | 2% | 2% |
| Native Hawaiian and other Pacific islander | < 1% | < 1% | < 1% | < 1% |
| Asian | 4% | < 1% | < 1% | < 1% |
| Native American and Alaska native | 2% | 4% | 3% | 1% |
| Black or African-American | 2.5% | < 1% | < 1% | < 1% |

## Poverty Rates

Overall poverty in the three socio-economic impact zones exceeds that found statewide in Oregon with the gap dramatically widening in 2009 for the Malheur and Wallowa-Whitman socio-economic impact zones. Poverty does not occur equally across all races and ethnic groups and is generally higher among minorities and Hispanics or Latinos.

In order to analyze poverty by race and ethnicity, 2000 census data are evaluated. At that time, the white, not Hispanic or Latino population had poverty rates of 10 percent for Oregon and 12 to 14 percent for the three socio-economic impact zones (see table 31). Poverty rates for Native Americans and Alaskan Natives, Hispanics or Latinos, and all other minority populations are about twice that of the white, not Hispanic or Latino population. The Native American and Hispanic categories are identified separately because these categories are proportionately larger than they are for Oregon. The high poverty rates show that environmental justice impacts may be an important consideration, even for the white, not Hispanic or Latino population in the evaluation of alternatives and decision making.

**Table 31. Poverty in Oregon and the socio-economic impact zones by race and ethnicity, 2000 (Census 2000)**

| Population | Oregon | Socio-economic Impact Zone | | |
|---|---|---|---|---|
| | | Malheur | Umatilla | Wallowa-Whitman |
| White, not Hispanic or Latino | 10% | 12% | 12% | 14% |
| Native American, Alaska native | 22% | 34% | 23% | 29% |
| Hispanic or Latino | 25% | 22% | 26% | 26% |
| All other minorities | 21% | 20% | 25% | 23% |

## Education

Another important measure of socio-economic resiliency is educational attainment. The number of people with a high school diploma or bachelor's degree can indicate the ability of an area to adapt to change. Table 32 identifies the portions of the adult population in Oregon and the three socio-economic impact zones in these two categories.

The percentage of adults with at least a high school diploma in Oregon exceeds all three socio-economic impact zones by one to three percentage points. The gap between the state and the three socio-economic impact zones is much greater with respect to higher education, especially for the Malheur socio-economic impact zone, where there is an 11 percent difference. Education is an important component of human capital that can increase the capability of a community to adapt to complex issues associated with social and economic change.

**Table 32. Educational attainment in Oregon and the socio-economic impact zones, 2000 (Census 2000)**

| State/Socio-economic Impact Zone | Percent of Population 25 Years and Older | |
|---|---|---|
| | High School Graduate or Higher | Bachelor's Degree or Higher |
| Oregon | 85% | 25% |
| Malheur | 83% | 14% |
| Umatilla | 82% | 19% |
| Wallowa-Whitman | 84% | 20% |

## Per Capita Income and Income Sources

Per capita income is an indicator of the socio-economic well-being of an area. It measures total annual income from all sources divided by the population. It shows the relative capability of the population to consume goods and services and potentially save for the future. Per capita income increased across Oregon and the three socio-economic impact zones comparing 2008 with 1999. However, the Malheur socio-economic impact zone has decreased from the high of 2003. Per capita income in 2008 for the Malheur and Wallowa-Whitman socio-economic impact zones was about 20 percent less than the statewide figure, which includes the major metropolitan areas. The per capita income for the nonmetropolitan counties of Oregon was similar to the per capita income in the three socio-economic impact zones (U.S. Department of Commerce 2010).

Comparing 1999 with 2008, all of the socio-economic impact zones increased in per capita income more than the statewide increase in Oregon of nine percent. The Umatilla socio-economic impact zone had the greatest increase (15 percent), while the Malheur socio-economic impact zone increased the least (10 percent). The increase in per capita income provides an incomplete picture of socio-economic well-being. An evaluation of the components of income showing the drivers of the change in per capita income can provide a more comprehensive picture of the emerging trends.

The components of income include wages (labor and proprietor income), dividends, interest and rent (investment income), and transfer payments (retirement, unemployment, Medicare, etc.). Within the Malheur socio-economic impact zone, wage earnings, dividends and interest, and rent declined to offset the increase in transfer payments. Total income was less in 2009 than in 1999. Per capita income increased in the Malheur socio-economic impact zone because the population loss was greater than the income loss. Wage earnings decreased from 55 to 50 percent of total income, and transfer payments increased from 20 to 28 percent of total income (U.S. Department of Commerce 2010).

Data for the components of income in the Umatilla socio-economic impact zone show a different picture. Each of the income components increased between 1999 and 2008. Wage income in 1999 comprised 61 percent of total income and decreased one percent by 2008. Transfer payments increased the most with a 41 percent gain so that it comprised 22 percent of total income in 2008, a four percent increase compared to 1999 (U.S. Department of Commerce 2010).

In the Wallowa-Whitman socio-economic impact zone during the period, wages increased by eight percent and transfer payments increased by 39 percent. These two components offset the two percent decrease in investment income so that overall income increased by 12 percent. The wage earnings portion of total income decreased two percent during the decade to 53 percent of total income). The transfer payments portion of total income increased by five percent (U.S. Department of Commerce 2010).

### Urban-rural Distribution

The U.S. Census Bureau classifies population as being urban or rural. Urban populations live in urban areas that have at least 50,000 residents or in urban places with 2,500 residents outside of urban areas. The urban-rural distinction is important because people classified as urban generally have better access to work opportunities, goods and services, and other amenities associated with more densely populated areas. All of the socio-economic impact zones have proportionately more of their residents living in rural areas than Oregon overall. The Malheur socio-economic impact zone has more than 70 percent of its population classified as rural, compared to just greater than 20 percent for the state. Slightly more than one-half of the Wallowa-Whitman socio-economic impact zone residents are rural, and 25 percent of the Umatilla socio-economic residents are rural (Census 2010).

### Employment and Income by Industry

Examining employment and income data by industry provides an indication about the relative importance of industries in the socio-economic impact zones and how those industries have changed between 2001 and 2009. A comparison of employment and income can reveal which types of jobs are high paying.

National forest management activities and the production of goods and services affect and influence several businesses within the industry sectors. Recreation expenditures contribute directly to lodging and restaurants under accommodation and food services as well as retail trade; timber production contributes directly to logging in agriculture and forestry as well as manufacturing; forage production contributes directly to ranching in the agriculture industry; and agency budgets contribute directly to a number of different businesses in addition to directly providing employment opportunities. These businesses in turn are important to accomplishing the Forest Service mission to sustain and restore the ecological integrity of the national forests as well as provide uses and goods and services to the public.

The job and income information presented here is from IMPLAN model data primarily based on the U.S. Census County Business Patterns, Bureau of Labor Statistics Covered Employment and Wages Program, and Bureau of Economic Analysis Regional Economic Information System. The data are organized by industry or industry group using the North American Industrial Classification System (NAICS). NAICS is the standard used by Federal agencies for classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy. The employment data includes both full- and part-time jobs, and the income data includes wages and proprietor income. Estimates for the self-employed are included, which is important in the logging industry. Income data for 2001 is converted to 2009 dollars using gross domestic product price deflators.

The Malheur socio-economic impact zone employment picture is changing (see figure 2, next page). In 2001, the agriculture, forestry, fishing, and hunting sector provided the most full- and part-time jobs followed closely by the government sector, with each providing more than 2,000 jobs. The agriculture, forestry, fishing, and hunting sectors include jobs related to commercial hunting and fishing. Jobs related to recreational hunting and fishing are accounted for in several sectors. State and local employment comprised about 78 percent of all government jobs in 2009. The services sectors and retail trade also provided a large amount of employment. By 2009, employment decreased in all sectors except government and health and social services, with the largest declines occurring in agriculture, retail trade, and other services. About one-third of the job loss in the agriculture, forestry, fishing and hunting sector was associated with declines in logging industry.

Income by industry for the Malheur socio-economic impact zone shows the dominance of the government sector (see figure 3, next page). About 50 percent of all labor income occurs in the government sector. There were general declines in income for most sectors similar to the declines in employment. However, there was an increase in health and social services, finance and retail trade, and the decline in agriculture was not as great as the decrease in employment.

Employment within the Umatilla socio-economic impact zone is not dominated by one or two sectors (see figure 4 on page 91). Employment is more evenly spread across several sectors providing less dependence on a single industry.

Similar to the Malheur socio-economic impact zone, there were declines in employment for most sectors and increases in government and health and social services. Government makes up less than 20 percent of all employment. State and local employment comprised about 92 percent of all government jobs in 2009.

Although income by industry for the Umatilla socio-economic impact zone shows the dominance of the government sector with more than 25 percent of all labor income, the rest of the income is distributed fairly evenly across several sectors (see figure 5 on page 91). Unlike the Malheur socio-economic impact zone, there were general increases in income for most sectors. Declines were notable in the construction and manufacturing sectors.

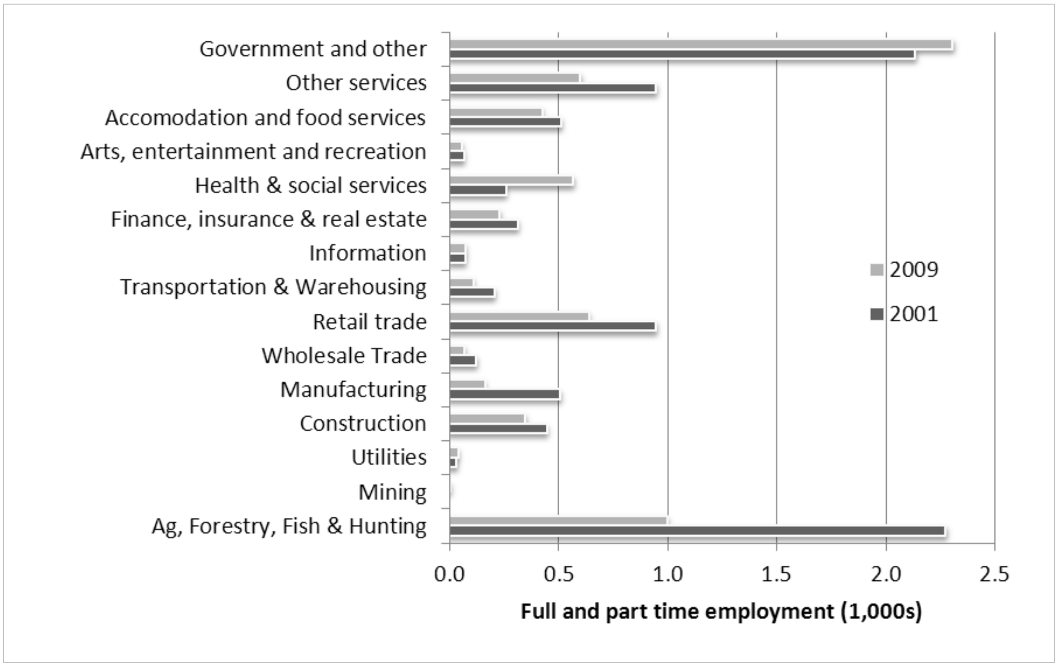


**Figure 2. Employment by industry for the Malheur socio-economic impact zone for 2001 and 2009 (Source: Minnesota Implan Group 2001 and 2009)**

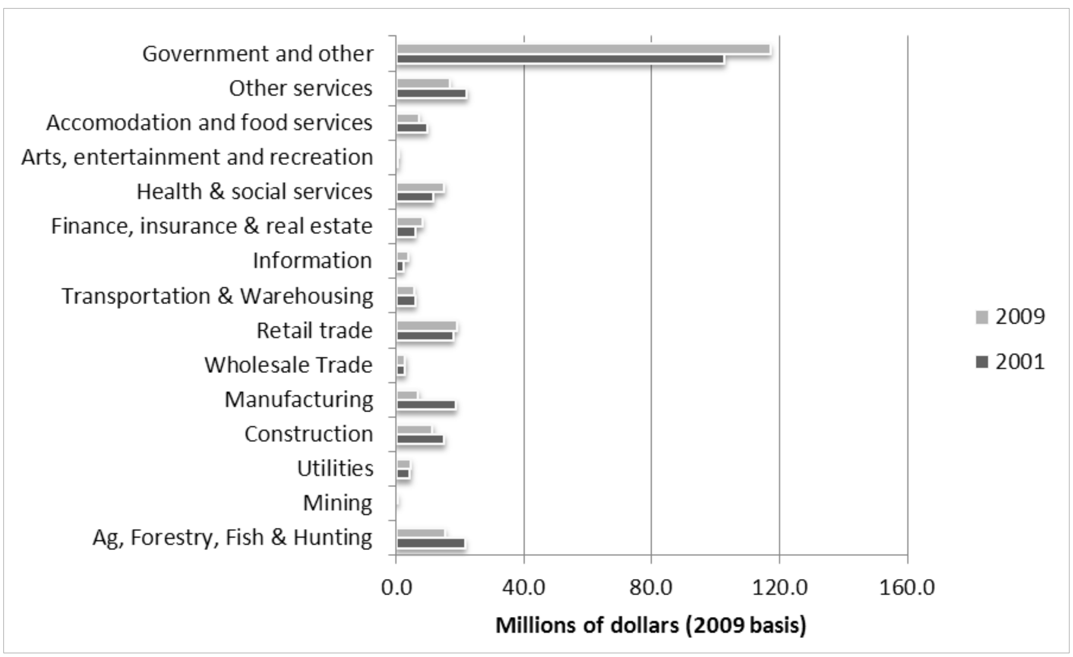


**Figure 3. Total wage and proprietor income by industry for the Malheur socio-economic impact zone for 2001 and 2009 (Source: Minnesota Implan Group 2001 and 2009)**

The distribution of employment within the Wallowa-Whitman socio-economic impact zone is similar to the Umatilla socio-economic impact zone in that it is more evenly spread across several sectors providing less dependence on a single industry (see figure 6 on page 92). Similar to the Malheur socio-economic impact zone, there were declines in employment for most sectors. However, in this socio-economic impact zone, government employment did not increase. The most prominent increase was in health and social services. The government sector contributes slightly less than 20 percent of all employment. State and local employment comprised about 87 percent of all government jobs in 2009.

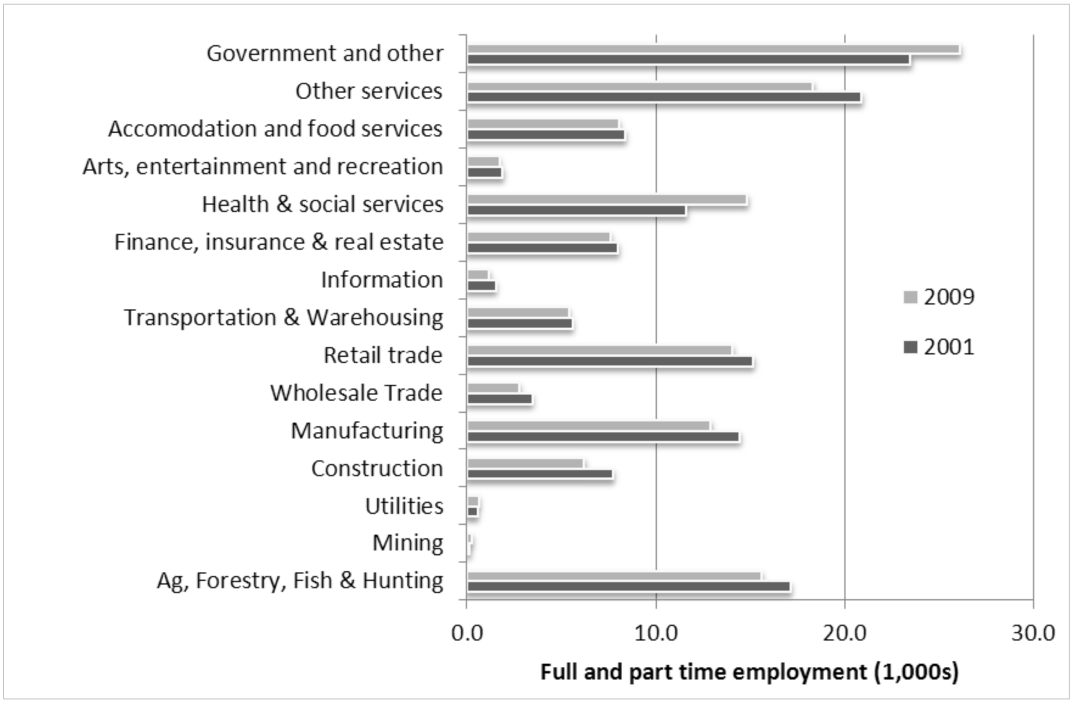


**Figure 4. Employment by industry for the Umatilla socio-economic impact zone for 2001 and 2009 (Source: Minnesota Implan Group 2001 and 2009)**

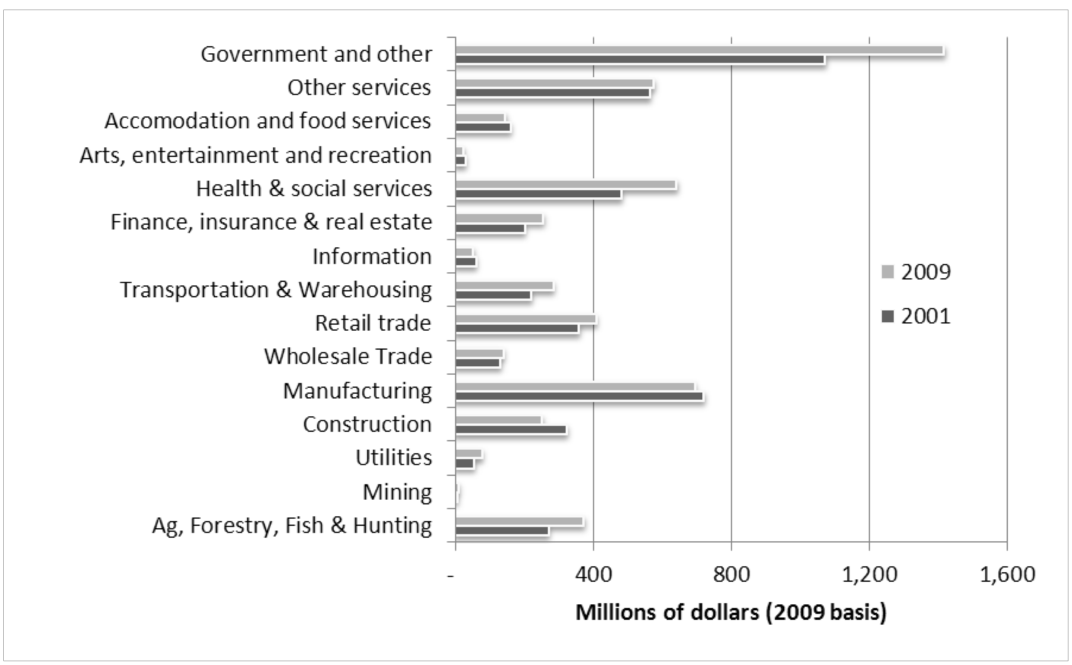


**Figure 5. Total wage and proprietor income by industry for the Umatilla socio-economic impact zone for 2001 and 2009 (Source: Minnesota Implan Group 2001 and 2009)**

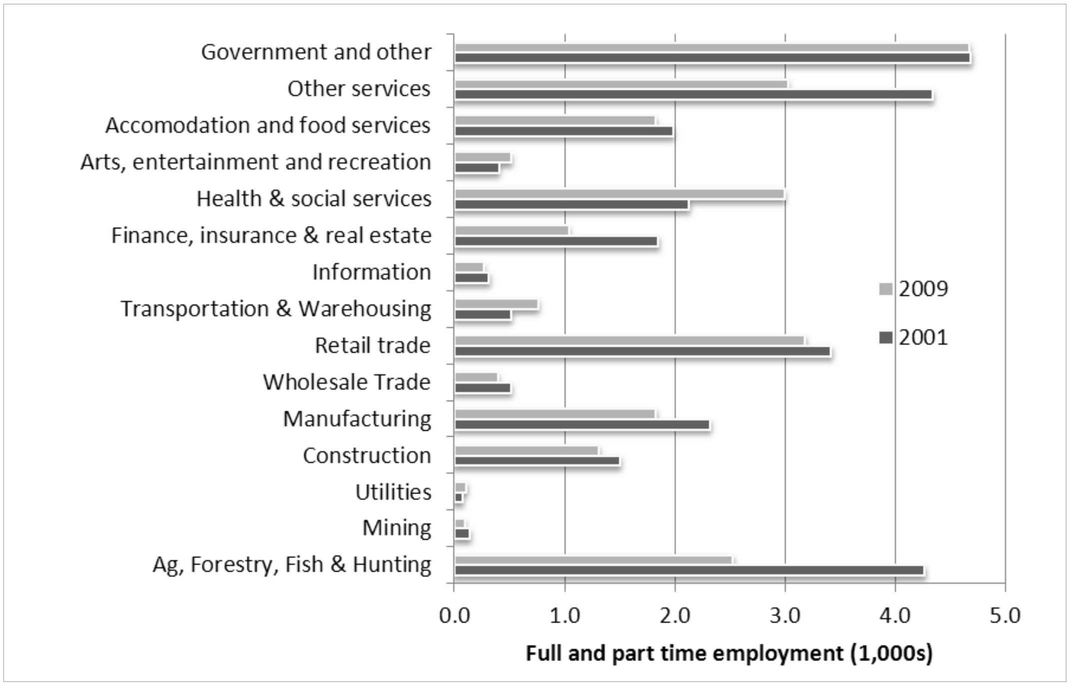


**Figure 6. Employment by industry for the Wallowa-Whitman socio-economic impact zone for 2001 and 2009 (Source: Minnesota Implan Group 2001 and 2009)**

There is a mix of increases and decreases with regards to the income by industry within the Wallowa-Whitman socio-economic impact zone. Government, health and social services, transportation and warehousing, and retail trade show sizeable increases in income (figure 7).

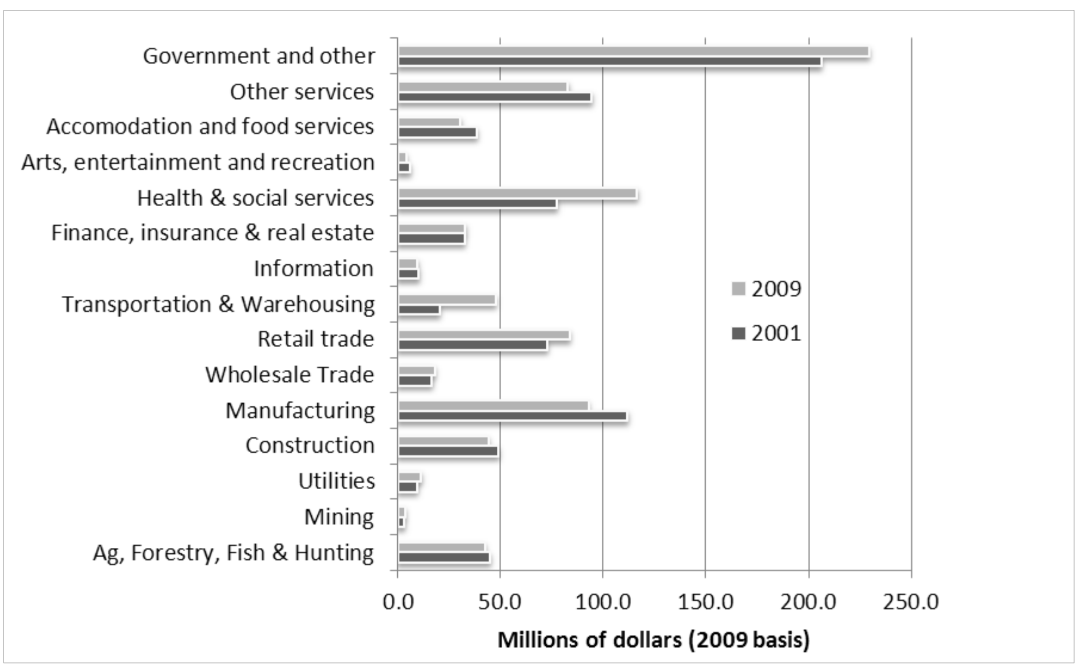


**Figure 7. Total wage and proprietor income by industry for the Wallowa-Whitman socio-economic impact zone for 2001 and 2009 (Source: Minnesota Implan Group 2001 and 2009)**

The dominance of the government sector is similar to the Umatilla socio-economic impact zone with more than 25 percent of all labor income. The rest of the income is distributed fairly evenly across several sectors. Declines were notable in the construction, manufacturing, accommodations and food services, and other services sectors.

## Economic Diversity

A diverse economy with varied employment opportunities can better withstand economic change. Specialized economies with dependence on a few industries for employment and income are less resilient to local changes and national fluctuations. A Shannon-Weaver diversity index is used to indicate the degree of economic specialization (Minnesota Implan Group 2009). The index ranges from zero, the most specialized, to one, the most diverse. Table 33 displays the diversity index of the three socio-economic impact zones and Oregon. The state's index is highest since it represents a diverse, statewide economy. The Malheur socio-economic impact zone has the lowest diversity index and may be the least resilient.

**Table 33. Economic diversity in Oregon and the socio-economic impact zones, 2009**

| Geographic Area | Diversity Index |
|---|---|
| Oregon | 0.75 |
| Malheur | 0.58 |
| Umatilla | 0.71 |
| Wallowa-Whitman | 0.69 |

Source: Minnesota Implan Group 2009

## Unemployment

Unemployment data for 2001 through 2010 are presented in table 34 for Oregon and the socio-economic impact zones; the figures are approximate. The data are annual rates and are not seasonally adjusted. Across the decade, the Umatilla socio-economic impact zone has fared the best with an unemployment rate equal to or less than the statewide rate. Unemployment within the Malheur socio-economic impact zone was always two to four percent greater than the state average, and the Wallowa-Whitman socio-economic impact zone was generally the same as or slightly higher than the state average.

**Table 34. Annual unemployment figures for Oregon statewide and the socio-economic impact zones for 2000-2010**

| | | Socio-economic Impact Zone | | |
|---|---|---|---|---|
| Year | Oregon | Malheur | Umatilla | Wallowa-Whitman |
| 2001 | 6.5% | 11% | 6.5% | 7.5% |
| 2002 | 7.5% | 9.5% | 7% | 7.5% |
| 2003 | 8% | 10.5% | 7.5% | 8% |
| 2004 | 7.5% | 9.5% | 7% | 8% |
| 2005 | 6.5% | 9.5% | 6.5% | 7% |
| 2006 | 5.5% | 8.5% | 5.5% | 6% |
| 2007 | 5% | 8% | 5% | 5.5% |
| 2008 | 6.5% | 10% | 6% | 7.5% |
| 2009 | 11% | 15% | 9% | 11% |
| 2010 | 10.5% | 14.5% | 9% | 10.5% |

Source: U.S. Bureau of Labor Statistics

## Human Uses and Values

The Blue Mountains national forests currently contribute to the area's economy and social conditions in a variety of ways that include the supply of products, services, and uses. These activities support direct, indirect, and induced jobs and income and generate tax revenue in the socio-economic impact zones. Not all resource outputs and purchases result in local economic activity. For example, logs harvested from one national forest may be sent to sawmills outside of its socio-economic impact zone. Similarly, a national forest may purchase goods and services from business from outside the socio-economic impact zone, such as restoration work contracted by non-local businesses or helicopter logging services. These activities do not contribute to local employment and income.

The following sections discuss the economic impacts related to recreation, range and timber uses, Forest Service expenditures, and revenue sharing and payments to counties. Not covered are minerals and non-timber forest products. Mineral production affects very few people and businesses. Non-timber forest products use and production data are limited and are not in a format useful for economic impact analysis.

### *Recreation (Dispersed, Developed, and Wildlife Related)*

Visitors to the Blue Mountains national forests have the opportunity to participate in a variety of activities in developed and dispersed settings. These activities include hiking, camping, and driving for pleasure as well as wildlife and fish use, such as hunting, fishing, and wildlife viewing. Recreation activities contribute to social and economic well-being in the socio-economic impact zones. In addition to economic benefits, recreation opportunities within the national forests enhance the quality of life for nearby residents.

Survey data for Forest Service related recreation were collected and analyzed for the National Visitor Use Monitoring (NVUM) system. Data for the first survey were collected between 2000 and 2003. The second round of NVUM data were collected for the three national forests in 2009. The scientists conducting the NVUM survey state that comparisons of the first and second round results are not appropriate due to changes in the study protocols. Only round 2 results are presented in table 35.

**Table 35. Total national forest site visits for 2009**

| National Forest | Number of Visits |
|---|---|
| Malheur | 261,400 |
| Umatilla | 379,800 |
| Wallowa-Whitman | 447,400 |

### *USDA Forest Service National Visitor Use Monitoring (NVUM) 2009*

Economic effects are based on expenditures for goods and services associated with recreation, including shopping at convenience stores or purchasing gasoline, food, lodging, outfitter guides, and sporting goods to name a few. The process used estimated visitor expenditures and is based on the procedures identified in the "Spending Profiles of National Forest Visitors, NVUM Round 2 Update" (White and Stynes. 2010). The visits are divided into six market segments to identify key differences in spending patterns of visitors (see table 36). The differences are local versus non-local visitors to identify dollars that are being brought into the socio-economic impact zones and overnight stays within the national forest versus overnight stays outside the national forest. The classifications are important because recreation expenditures and their effects on local economies are different. Trip expenditures by local day visitors are much less than expenditures by non-local visitors staying overnight. Day use visitors do not require lodging and typically spend less on other goods and services. Two additional market segments, downhill skiing day and downhill skiing overnight, are also considered to recognize the expense of lift tickets.

**Table 36. Market segments of national forest visitors for 2009**

| Market Segment | National Forest | | |
|---|---|---|---|
| | MAL | UMA | WAW |
| Non-local day | 13,072 | 73,163 | 59,465 |
| Non-local overnight within the national forest | 120,260 | 44,888 | 84,949 |
| Non-local overnight outside of the national forest | 13,072 | 7,595 | 63,712 |
| Local day | 75,816 | 44,888 | 55,217 |
| Local overnight within the national forest | 10,457 | 20,717 | 12,742 |
| Local overnight outside of the national forest | 0 | 7,250 | 12,742 |
| Non-primary | 28,758 | 25,549 | 135,919 |

The Forest Service also bridged the recreational expenditures to IMPLAN model sectors so the economic effects of recreational uses can be estimated. These expenditure profiles are developed for each of the six market segments and downhill skiing. The IMPLAN model expenditure profiles are combined with the recreation use by market segment to estimate the direct, indirect and induced employment, income and tax effects (see table 37).

**Table 37. Recreation, wildlife, and fish economic impacts by national forests and their socio-economic impact zones (dollar estimates are in 2010 dollars)**

| Impact | National Forest/Socio-economic Impact Zone | | |
|---|---|---|---|
| | Malheur | Umatilla | Wallowa-Whitman |
| **Non-local recreation use** | | | |
| Jobs | 88 | 95 | 251 |
| Income | $1,721,000 | $2,199,000 | $4,659,000 |
| State and local tax | $503,000 | $527,000 | $1,309,000 |
| Federal tax | $462,000 | $563,000 | $1,325,000 |
| **Non-local wildlife recreation use** | | | |
| Jobs | 116 | 22 | 70 |
| Income | $2,292,000 | $573,000 | $1,412,000 |
| State and local tax | $687,000 | $146,000 | $406,000 |
| Federal tax | $615,000 | $146,000 | $400,000 |
| **Local recreation use** | | | |
| Jobs | 13 | 55 | 57 |
| Income | $256,000 | $1,349,000 | $1,149,000 |
| **Local wildlife recreation use** | | | |
| Jobs | 16 | 15 | 20 |
| Income | $321,000 | $405,000 | $458,000 |

### *Rangeland and Grazing*

Livestock grazing within the Blue Mountains national forests is an important use to the local ranching industry. Grazing on public lands contributes directly to livestock forage needs. In 2009, the counties in the Oregon portion of the plan revision area had about 40 percent of the total cattle inventory of the state (USDA National Agriculture Statistics Service). Grazing on National Forest System lands (see table 38) directly provided about three percent of the forage needs of the local cattle inventory. The total contribution of grazing on National Forest System lands is likely understated since it affords ranchers the opportunity to grow forage on other ranch lands for feed.

Livestock grazing is measured in head months (HMs) and animal unit months (AUMs) for permitted use and authorized use. One AUM is the amount of forage a 1,000-pound mature cow and a calf consume in a 30-day period, which is about 780 pounds of dry weight. A head month is a month's use and occupancy of range by one adult (including weaned) animal, except for sheep or goats. Five sheep or goats, weaned or adult, are considered equivalent to one cow.

**Table 38. Average livestock grazing data by national forest for 2007 through 2009**

| Livestock Grazing | MAL | UMA | WAW |
|---|---|---|---|
| **Permitted Grazing (proclaimed and administered lands)** | | | |
| Cattle (HMs) | 94,128 | 30,499 | 90,810 |
| Cattle (AUMs) | 124,028 | 40,259 | 119,321 |
| Horses and burros (HMs) | 110 | 0 | 252 |
| Horses and burros (AUMs) | 132 | 0 | 302 |
| Sheep and goats (HMs) | 23,995 | 25,503 | 15,118 |
| Sheep and goats (AUMs) | 7,199 | 7,651 | 4,535 |
| **Authorized Grazing (proclaimed and administered lands)** | | | |
| Cattle (HMs) | 70,989 | 26,782 | 83,309 |
| Cattle (AUMs) | 92,937 | 35,352 | 109,808 |
| Horses and Burros (HMs) | 72 | 0 | 206 |
| Horses and Burros (AUMs) | 86 | 0 | 234 |
| Sheep and Goats(HMs) | 10,910 | 16,511 | 12,769 |
| Sheep and Goats(AUMs) | 3,273 | 4,953 | 3,830 |
| **Authorized Grazing as percent of Permitted Grazing** | | | |
| Cattle (HMs) | 75% | 88% | 92% |
| Cattle (AUMs) | 75% | 88% | 92% |
| Horses and burros (HMs) | 65% | NA | 82% |
| Horses and burros (AUMs) | 65% | NA | 78% |
| Sheep and goats (HMs) | 45% | 65% | 84% |
| Sheep and goats (AUMs) | 45% | 65% | 84% |

Source: USDA Forest Service, iWeb Grazing Reports

Permitted AUMs are measures of planned capacity and are the number of AUMs that are specified by the grazing permit for the duration of the permit (FSM 2230.5). The permit is usually valid for 10 years (FSM 2231.03). Permitted AUMs provides a comparable indicator for Forest Service and BLM grazing capacity. Authorized AUMs is the amount of forage permittees pay for and are authorized to use in a given year. Authorized AUMs indicate how much of the planned capacity is used annually. It is this use amount that contributes to jobs and income. Authorized cattle use across all three national forests is about 80 percent of permitted use. Sheep and goats authorized use is about 50 percent of permitted use. Sheep and goats make up about five percent of grazing use on the three national forests.

The economic activity associated with Forest Service livestock grazing is based on the proportion of livestock forage consumed by animals authorized to graze on Forest Service allotments to total annual forage needs in each socio-economic impact zone. The Forest Service contribution is identified as part of the total cattle and sheep inventory, marketing, and income data from the USDA National Agriculture Statistics Service. Average grazing data for 2007 through 2009 are displayed in table 38. This data is then integrated into IMPLAN model to generate the direct, indirect, and induced employment, income, and tax revenues that are contributed by each national forest.

The jobs, income, and tax contributions associated with current livestock grazing on the three national forests and their socio-economic impact zones are displayed in table 39. The effects are based on the average authorized grazing for 2007 through 2009 (as displayed in table 38) and the IMPLAN 2010 model year. The data include direct, indirect, and induced effects and include estimates for unpaid or family labor contributions.

**Table 39. Livestock grazing economic impacts by national forests and their socio-economic impact zones (dollar estimates are in 2010 dollars)**

| | National Forest/Socio-economic Impact Zone | | |
|---|---|---|---|
| **Impact** | **Malheur** | **Umatilla** | **Wallowa-Whitman** |
| Jobs | 389 | 153 | 258 |
| Income | $5,195,000 | $1,874,000 | $3,435,000 |
| State and local tax | $909,000 | $439,000 | $836,000 |
| Federal tax | $998,000 | $606,000 | $932,000 |

### *Forest Products*

The Blue Mountains national forests have a long history of providing timber and other forest products to address local community and national needs. Until recently, communities throughout the socio-economic impact zones had strong economic components related to the wood products industry. Increased environmental protection, a focus on sustaining and restoring a broader range of resources, and changing mill technology have resulted in significant declines in the timber industry and in the businesses that support the timber industry.

Annual timber volume harvested from the three national forests, excluding fuelwood, has declined dramatically, from a high of almost 600 million board feet during the early 1990s to about 50 million board feet in 2010. Harvest on all other ownerships has also declined during the same period. The recent three-year average timber harvest by national forest is displayed in table 40. Non-sawtimber includes pulpwood and biomass, such as clean chips. Fuelwood includes both personal and commercial use.

**Table 40. Timber harvest volume three-year average by national forest (in MBF and CCF)**

| Timber Product | MAL (2006-08)* | | UMA (2007-09) | | WAW (2007-09) | |
|---|---|---|---|---|---|---|
| | MBF | CCF | MBF | CCF | MBF | CCF |
| Sawtimber | 13,024 | 26,048 | 20,480 | 40,961 | 10,160 | 20,321 |
| Non-sawtimber | 191 | 382 | 9,402 | 22,386 | 3,958 | 9,425 |
| Poles | 77 | 172 | 66 | 146 | 73 | 162 |
| Posts | 4 | 9 | 2 | 5 | 0 | 1 |
| Fuelwood | 3,110 | 6,219 | 5,493 | 10,986 | 6,003 | 12,007 |
| Totals | 16,406 | 32,830 | 35,444 | 74,484 | 20,195 | 41,915 |

* The average data for the Malheur National Forest are based on 2006-08 because there was an uncommonly large amount of biomass volume included in the timber harvest statistics in 2009.

Between 1989 and 2008, wood products processing capacity changed in the Oregon counties across all of the socio-economic impact zones. Data for Washington and Idaho were not available. There was a decrease in sawmill production capacity of almost 60 percent (see figure 8). Manufactured board processing decreased by about 30 percent, and there was close to a 10 percent reduction in plywood and veneer processing. Pulp processing capacity remained about the same. Processing capacity is important for several reasons. It generates value added jobs and income in addition to those jobs associated with logging. Local processing capacity increases the net value of stumpage since it costs more to ship logs to distant mills. A higher stumpage value means projects are more likely to be economically viable.

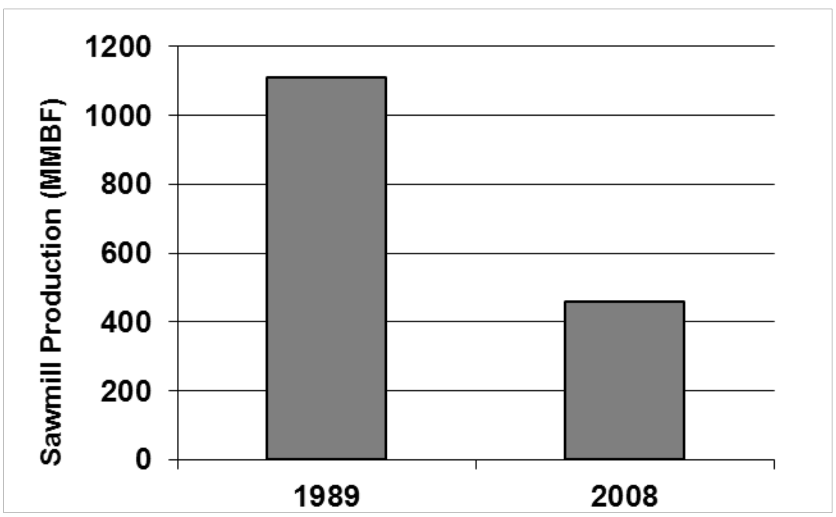


**Figure 8. Sawmill production in the Oregon portion of the three socio-economic impact zones (Source: Ehinger and Assoc. 2008)**

The economic activity associated with timber harvest is calculated on a per hundred cubic feet (CCF) basis. The flows of stumpage through logging companies and primary processors (such as sawmills, veneer and plywood mills, and paperboard manufactures) are considered. The harvest data in MBF and CCF by national forest are displayed in table 41.

**Table 41. Timber harvest by product type for the Blue Mountains national forests**

| Timber Product | Malheur (2006-08)* | | Umatilla (2007-09) | | Wallowa-Whitman (2007-09) | |
|---|---|---|---|---|---|---|
| | MBF | CCF | MBF | CCF | MBF | CCF |
| Sawtimber | 13,024 | 26,048 | 20,480 | 40,961 | 10,160 | 20,321 |
| Non-sawtimber | 191 | 382 | 9,402 | 22,386 | 3,958 | 9,425 |
| Poles | 77 | 172 | 66 | 146 | 73 | 162 |
| Posts | 4 | 9 | 2 | 5 | 0 | 1 |
| Fuelwood | 3,110 | 6,219 | 5,493 | 10,986 | 6,003 | 12,007 |
| Totals | 16,406 | 32,830 | 35,444 | 74,484 | 20,195 | 41,915 |

* includes timber volume from the Ochoco National Forest

The direct economic effect of the timber program is derived using mill survey data provided by Charles E. Keegan, Bureau of Business and Economic Research, The University of Montana. The direct job effect of timber harvest is determined by identifying the timber volume processed or handled by an industry, such as sawmills, and dividing the total employment for that industry by that number. The process derives a response coefficient for jobs per CCF. The response coefficient is integrated with the IMPLAN models for each socio-economic impact zone to calculate the rest of the direct, indirect and induced employment, income, and tax effects for the timber industries and supporting businesses that exist in each socio-economic impact zone. These contributions associated with the timber harvested from the three national forests and their socio-economic impact zones are displayed in table 42.

**Table 42. Timber harvest economic impacts for the socio-economic impact zones (dollar estimates are in 2010 dollars)**

| Impact | National Forest/Socio-economic Impact Zone | | |
|---|---|---|---|
| | Malheur | Umatilla | Wallowa-Whitman |
| Jobs | 74 | 321 | 158 |
| Income | $3,994,000 | $18,306,000 | $8,717,000 |
| State and local tax | $510,000 | $2,516,000 | $1,365,000 |
| Federal tax | $752,000 | $4,192,000 | $2,028,000 |

## National Forest Expenditures (Salary and Non-salary)

Within the Blue Mountains national forests, Forest Service people, budgets, buildings, and other infrastructure contribute to social and economic well-being in the communities making up each of the socio-economic impact zones. The management of each of the national forests requires a budget that is spent on employees, contractors, goods and services, and the construction and maintenance of infrastructure. In addition to the day-to-day scheduled management activities, the Forest Service sometimes spends additional money for unplanned activities, such as wildfire suppression and management. The expenditures for each national forest are divided into salary and non-salary components and displayed including and excluding wildfire suppression costs (see table 43).

**Table 43. Average national forest expenditures for 2007 through 2009**

| Expenditures | Malheur | Umatilla | Wallowa-Whitman |
|---|---|---|---|
| Salary excluding fire suppression | $11,086,000 | $11,116,000 | $14,229,000 |
| Non-salary excluding fire suppression | $7,913,000 | $8,378,000 | $8,735,000 |
| Salary including fire suppression | $21,094,000 | $18,852,000 | $19,697,000 |
| Non-salary including fire suppression | $14,055,000 | $14,519,000 | $17,424,000 |

The economic effects of salary and non-salary expenditures by the Forest Service are estimated using the disposable income spent locally by Forest Service employees and the non-salary expenditures spent locally on materials, contracts, and services (see table 44). Salary expenditures are converted to disposable income spent by employees using a factor of slightly more than 60 percent. The remaining salary generally pays taxes and is saved for retirement, which is not spent locally by the employees. The non-salary expenditures are modeled with the assumption that if the good or service exists within the socio-economic impact zone, it will be purchased locally. The economic impacts are calculated using budgets excluding fire suppression costs. The reason for not identifying the economic effects associated with fire suppression expenditures is that suppression activities are not predictable, and most of the expenditures are spent on resources from outside of the national forests' socio-economic impact zones. The portion spent locally is not identified.

**Table 44. The economic impacts of national forest budgets (excluding fire suppression) within their socio-economic impact zones (dollar estimates are in 2010 dollars)**

| Impact | National Forest/Socio-economic Impact Zone | | |
|---|---|---|---|
| | Malheur | Umatilla | Wallowa-Whitman |
| Jobs | 362 | 394 | 467 |
| Income | $17,179,000 | $19,377,000 | $22,829,000 |
| State and local tax | $1,097,000 | $1,237,000 | $1,531,000 |
| Federal tax | $1,537,000 | $2,036,000 | $2,273,000 |

## Revenue Sharing and Payments to Counties

Counties receive Federal payments based on revenue sharing under the Payments to States Act, also known as 25-percent receipts, and based on the percentage of their land base that is federally administered under the Payments in Lieu of Taxes (PILT) program. Due to declining revenues, especially from timber receipts, the Payments to States Act money was supplemented with the Secure Rural Schools and Communities Self-Determination Act (SRS). SRS money is divided into three separate parts identified as Title 1, Title 2 and Title 3. Title 1 money, about 80 percent of the total, is spent on local roads and schools. The split of Title 1 money between roads and schools is 50:50 in Washington and Idaho. In Oregon, the split is 75:25 with roads getting the larger share. The remaining money is spent on ecosystem management projects on National Forest System lands and local government projects enhancing environmental education, public safety, and other projects. PILT money can be spent on any local government purpose.

The last payment under the original SRS was originally planned for 2006. An extension of the SRS payments was signed into law in 2007, and the next year, the Emergency Stabilization Act of 2008 was signed into law authorizing the SRS payments through 2011. The SRS payment was extended again for 2012 and congress is discussing continuing SRS in 2013. Because SRS payments are subject to congressional approval, an analysis of revenue sharing without the SRS adjustment is provided.

Table 45 displays the amounts of SRS and PILT money paid in 2009 to the counties in each of the socio-economic impact zones. The payments are based on the acreage of the national forest in each county for their respective socio-economic impact zone. For example, the Malheur and Umatilla National Forests have acreage in Grant County and the county is included in each of their socio-economic impact zones. The payment was prorated based on the number of acres of each national forest in their respective socio-economic impact zone. The allocation of SRS payments from each national forest to their socio-economic impact zone was accomplished using a similar proration of acreage by county. In 2009, Umatilla County did not choose the SRS payment and opted for the 25-percent receipts payment. This payment is included in table 45.

**Table 45. Total Forest Service SRS and PILT payments to socio-economic impact zones for 2009**

| Payment Type | National Forest/Socio-economic Impact Zone | | |
|---|---|---|---|
| | **Malheur** | **Umatilla** | **Wallowa-Whitman** |
| SRS | $7,900,754 | $3,151,705 | $2,714,318 |
| PILT | $453,467 | $745,694 | $1,157,956 |
| **Totals** | **$8,354,221** | **$3,897,399** | **$3,872,274** |

Since it is unknown whether the SRS payments will be continued into the future, an estimate of payments to states is provided in table 46. The revenue sharing data are based on forest fund receipts received in 2007. The data are used to reconstruct what the payments would have been without SRS. The payments estimated in table 46 show a drop of 85 percent or greater from payments received under SRS.

**Table 46. Reconstructed Forest Service 25-percent payments to socio-economic impact zones based on 2007 data**

| Payment Type | Socio-economic Impact Zone | | |
|---|---|---|---|
| | **Malheur** | **Umatilla** | **Wallowa-Whitman** |
| 25-Percent (reconstructed) | $294,487 | $475,001 | $182,314 |

In order to understand the importance and variability of revenue sharing and PILT payments to the individual counties, total SRS and 25-percent payments by county for selected years are provided in table 47 and PILT payment are displayed in table 48. The data displayed in table 47 are total payments received from all national forests. The years that are selected show key differences in payment amounts. The 1986 and 1991 years show fairly high amounts typical of the 1980s when there was an emphasis on timber production. In the year 2000, there are large decreased in revenue sharing dollars due to the impacts of several environmental protection policies. However, with the passage of the SRS in 2000, levels of payments increased to the higher levels received during the 1980s as shown by the data in 2003 and 2009. Nez Perce is not included since historic data are not readily available.

**Table 47. Total payments (SRS or 25 percent) to counties for selected years**

| County | 1986 | 1991 | 2000 | 2003 | 2009 |
|---|---|---|---|---|---|
| Baker | $1,215,705 | $1,176,072 | $240,973 | $1,236,929 | $1,048,663 |
| Grant | $9,104,248 | $10,754,046 | $380,293 | $9,867,839 | $8,365,916 |
| Harney | $4,136,316 | $5,089,341 | $93,847 | $4,050,347 | $3,433,869 |
| Morrow | $216,029 | $376,524 | $42,841 | $363,432 | $308,116 |
| Umatilla | $608,983 | $1,018,318 | $122,239 | $991,609 | $123,493 |
| Union | $907,936 | $944,078 | $226,741 | $832,113 | $858,555 |
| Wallowa | $1,275,445 | $1,117,680 | $392,763 | $1,352,045 | $1,146,258 |
| Wheeler | $1,243,518 | $1,640,000 | $28,337 | $1,145,063 | $970,780 |
| Asotin | $81,096 | $141,348 | $16,083 | $142,603 | $120,899 |
| Columbia | $240,461 | $419,076 | $47,683 | $422,746 | $358,403 |
| Garfield | $143,914 | $250,833 | $28,540 | $253,069 | $214,551 |
| Walla Walla | $3,668 | $6,393 | $727 | $6,407 | $5,432 |

The reasons for differences in PILT payments across the years displayed in table 48 are difficult to identify. The amount of PILT payment was affected by new PILT legislation passed in 1994, changes based on consumer price indices, the amount of prior year payments such as SRS, changing population and the amount of payment actually appropriated by Congress. The major point to take from table 48 is PILT payments are an important source of revenue to the counties.

**Table 48. Total PILT payments to counties for selected years**

| County | 1988 | 1991 | 2000 | 2002 | 2009 |
|---|---|---|---|---|---|
| Baker | $101,718 | $101,799 | $377,545 | $675,881 | $500,966 |
| Grant | $174,177 | $174,733 | $185,980 | $347,883 | $571,881 |
| Harney | $308,000 | $308,000 | $324,916 | $518,880 | $971,822 |
| Morrow | $15,936 | $15,431 | $95,999 | $158,929 | $66,704 |
| Umatilla | $42,787 | $41,668 | $265,205 | $440,521 | $264,036 |
| Union | $62,316 | $62,313 | $388,683 | $640,353 | $636,858 |
| Wallowa | $116,334 | $116,313 | $153,028 | $313,148 | $381,307 |
| Wheeler | $27,545 | $29,022 | $56,722 | $99,743 | $98,551 |
| Asotin | $8,238 | $6,564 | $48,429 | $76,353 | $103,553 |
| Columbia | $16,452 | $16,451 | $113,505 | $180,939 | $199,481 |
| Garfield | $10,118 | $10,118 | $70,415 | $112,410 | $107,867 |
| Walla Walla | $13,641 | $8,363 | $18,177 | $28,352 | $49,671 |
| Nez Perce | $15,501 | $14,433 | $26,393 | $40,952 | $72,721 |

The amount of Federal land in a county is an indicator of the social and economic relationships, including PILT payments, to the counties. Table 49 displays the total acres of each county and acres administered by the Forest Service, BLM, and all Federal public acres.

**Table 49. Total acres and federal components by county (2009)**

| County | Total | BLM | FS | All Federal | Percent Federal |
|---|---|---|---|---|---|
| Baker | 1,963,750 | 367,086 | 651,866 | 1,020,858 | 52% |
| Grant | 2,897,920 | 171,211 | 1,578,057 | 1,752,049 | 60% |
| Harney | 6,545,920 | 3,881,161 | 520,616 | 4,462,276 | 68% |
| Morrow | 1,311,360 | 1,609 | 143,305 | 149,695 | 11% |
| Umatilla | 2,067,840 | 7,345 | 401,398 | 419,459 | 20% |
| Union | 1,304,320 | 6,452 | 617,288 | 624,349 | 48% |
| Wallowa | 2,017,920 | 18,207 | 1,149,980 | 1,168,195 | 58% |
| Wheeler | 1,160,320 | 131,498 | 169,345 | 301,927 | 26% |
| Asotin | 407,174 | 13,936 | 53,797 | 69,475 | 17% |
| Columbia | 555,923 | 519 | 159,500 | 164,287 | 30% |
| Garfield | 454,842 | 363 | 95,466 | 101,788 | 22% |
| Walla Walla | 812,883 | 630 | 2,433 | 22,510 | 3% |
| Nez Perce | 542,778 | 27,277 | 2,705 | 31,524 | 6% |

SRS and PILT payments to counties are a component of local government expenditures. In order to calculate the economic contribution of the payments, the money is applied to several sectors using the IMPLAN model. All of the PILT payment is applied to the non-schools local government sector. The SRS payment is split four ways to recognize the split between roads and schools, and SRS Title allocations.

The jobs, income and tax impacts are identified in table 50. The effects are based on the payments received by socio-economic impact zone identified in table 49 and the IMPLAN 2010 model year. The data include direct, indirect, and induced effects.

**Table 50. Economic impacts of Forest Service payments to counties within the socio-economic impact zones (dollar estimates are in 2010 dollars)**

| Impact | National Forest/Socio-economic impact Zone | | |
|---|---|---|---|
| | Malheur | Umatilla | Wallowa-Whitman |
| Jobs | 139 | 68 | 72 |
| Income | $4,479,000 | $2,547,000 | $2,389,000 |
| State and local tax | $409,000 | $212,000 | $232,000 |
| Federal tax | $680,000 | $441,000 | $433,000 |

If SRS payments are not extended and revenue sharing is based on 25-percent payments, the jobs, income and tax impacts would be greatly reduced. Table 51 displays the estimated job, income and tax impacts of the estimated 25-percent payments reconstructed from 2007 data and actual PILT payment data for 2009.

**Table 51. Estimated economic impacts of Forest Service payments to counties without SRS within the socio-economic impact zones**

| Impact | National Forest/Socio-economic impact Zone | | |
|---|---|---|---|
| | Malheur | Umatilla | Wallowa-Whitman |
| Jobs | 12 | 20 | 24 |
| Income | $425,000 | $792,000 | $862,000 |
| State and local tax | $43,000 | $69,000 | $91,000 |
| Federal tax | $82,000 | $157,000 | $194,000 |

## Social and Economic Contributions Summary

The economic effects of recreation, range, timber, agency expenditures, and payments to counties discussed previously are combined and displayed in a table for each national forest and its socio-economic impact zone (see table 52 through table 54). The data for jobs and income contributed by the Forest Service are compared to the total jobs and income by industry sector to identify the relative importance of the national forest to that sector and to the socio-economic impact zone overall. The data are from IMPLAN 2010 data sets.

The Forest Service economic relationship to the Malheur socio-economic impact zone shows strong economic ties with about 15 percent overall contribution to total employment and labor income. Several industries with large numbers of jobs show contributions of 10 percent or more based on goods and services provided by the national forest and budget expenditures and payments to counties. The jobs and income supported through Forest Service management activities are very important components of the Malheur socio-economic impact zone's socio-economic well-being.

The Forest Service contributes slightly more than 1 percent to total employment and 2 percent of labor income in the Umatilla socio-economic impact zone. The contributions by industry sector are also generally 1 percent or less. The jobs and income supported through Forest Service management activities, though less important to socio-economic impact zone's economy overall, are important to the socio-economic well-being of some individual businesses, workers, and families.

The Forest Service economic relationship to the Wallowa-Whitman socio-economic impact zone shows moderate economic ties with an almost 5 percent contribution to total employment and slightly more than a 5 percent contribution to labor income. Recreation related industries, such as retail trade, arts, entertainment and recreation, and accommodation and food services, show contributions of 10 percent or more. The jobs and income supported through Forest Service management activities are moderately important components of the Wallowa-Whitman socio-economic impact zone's socio-economic well-being.

**Table 52. Current contribution of the Forest Service to the Malheur socio-economic impact zone excluding fire suppression dollars**

| | Employment (jobs) | | | Labor Income (thousands of 2010 dollars) | | |
|---|---|---|---|---|---|---|
| **Industry** | **Area Totals** | **National Forest Related** | **National Forest Percent of Total** | **Area Totals** | **National Forest Related** | **National Forest Percent of Total** |
| Agriculture | 1,457 | 385 | 26.4% | 25,390 | 4,346 | 17.1% |
| Mining | 21 | 20 | 94.1% | 143 | 356 | 249.3% |
| Utilities | 18 | 2 | 9.1% | 1,943 | 185 | 9.5% |
| Construction | 365 | 13 | 3.6% | 10,383 | 406 | 3.9% |
| Manufacturing | 177 | 36 | 20.5% | 6,124 | 1,944 | 31.7% |
| Wholesale trade | 103 | 19 | 18.2% | 4,373 | 1,042 | 23.8% |
| Transportation and warehousing | 104 | 24 | 22.6% | 3,469 | 1,004 | 28.9% |
| Retail trade | 845 | 81 | 9.6% | 17,112 | 1,697 | 9.9% |
| Information | 81 | 9 | 10.8% | 3,214 | 396 | 12.3% |
| Finance and insurance | 254 | 25 | 9.9% | 7,812 | 1,083 | 13.9% |
| Real estate and rental and leasing | 237 | 29 | 12.3% | 3,044 | 563 | 18.5% |
| Professional, scientific, and technical services | 186 | 42 | 22.3% | 4,725 | 1,210 | 25.6% |
| Management of companies | 9 | 1 | 6.6% | 651 | 66 | 10.2% |
| Administrative, waste management, and removal services | 232 | 19 | 8.1% | 3,357 | 371 | 11.0% |
| Educational services | 67 | 7 | 10.3% | 438 | 109 | 24.8% |
| Health care and social assistance | 695 | 43 | 6.2% | 18,134 | 1,480 | 8.2% |
| Arts, entertainment, and recreation | 118 | 36 | 30.1% | 519 | 276 | 53.1% |
| Accommodation and food services | 489 | 108 | 22.0% | 6,381 | 1,510 | 23.7% |
| Other services | 369 | 21 | 5.7% | 8,568 | 640 | 7.5% |
| Government | 2,054 | 251 | 12.2% | 103,058 | 16,152 | 15.7% |
| Totals | 7,881 | 1,168 | 14.8% | 228,838 | 34,837 | 15.2% |

**Table 53. Current contribution of the Forest Service to the Umatilla socio-economic impact zone excluding fire suppression dollars**

| | Employment (jobs) | | | Labor Income (thousands of 2010 dollars) | | |
|---|---|---|---|---|---|---|
| **Industry** | **Area Totals** | **National Forest Related** | **National Forest Percent of Total** | **Area Totals** | **National Forest Related** | **National Forest Percent of Total** |
| Agriculture | 18,959 | 241 | 1.3% | $326,659 | $6,942 | 2.1% |
| Mining | 274 | 8 | 2.8% | $12,999 | $144 | 1.1% |
| Utilities | 611 | 3 | 0.5% | $69,527 | $383 | 0.6% |
| Construction | 6,163 | 9 | 0.2% | $234,201 | $406 | 0.2% |
| Manufacturing | 13,089 | 116 | 0.9% | $693,676 | $7,957 | 1.1% |
| Wholesale trade | 3,081 | 19 | 0.6% | $143,487 | $1,000 | 0.7% |
| Transportation and warehousing | 4,761 | 26 | 0.5% | $275,252 | $1,537 | 0.6% |
| Retail trade | 14,859 | 67 | 0.4% | $378,623 | $1,728 | 0.5% |
| Information | 1,396 | 8 | 0.5% | $50,682 | $288 | 0.6% |
| Finance and insurance | 6,518 | 28 | 0.4% | $264,321 | $1,242 | 0.5% |
| Real estate and rental and leasing | 4,013 | 23 | 0.6% | $52,815 | $354 | 0.7% |
| Professional, scientific, and technical services | 5,401 | 40 | 0.7% | $175,315 | $1,384 | 0.8% |
| Management of companies | 464 | 2 | 0.4% | $36,087 | $167 | 0.5% |
| Administrative, waste management, and removal services | 5,201 | 23 | 0.4% | $139,256 | $473 | 0.3% |
| Educational services | 2,044 | 6 | 0.3% | $73,919 | $188 | 0.3% |
| Health care and social assistance | 16,548 | 62 | 0.4% | $694,810 | $2,844 | 0.4% |
| Arts, entertainment, and recreation | 1,940 | 31 | 1.6% | $18,157 | $376 | 2.1% |
| Accommodation and food services | 8,403 | 78 | 0.9% | $134,731 | $1,319 | 1.0% |
| Other services | 7,715 | 29 | 0.4% | $211,656 | $971 | 0.5% |
| Government | 24,056 | 237 | 1.0% | 1,225,030 | 15,200 | 1.2% |
| Totals | 18,959 | 241 | 1.3% | $326,659 | $6,942 | 2.1% |

**Table 54. Current contribution of the Forest Service to the Wallowa-Whitman socio-economic impact zone excluding fire suppression dollars**

| Industry | Employment (jobs) | | | Labor Income (thousands of 2010 dollars) | | |
|---|---|---|---|---|---|---|
| | Area Totals | National Forest Related | National Forest Percent of Total | Area Totals | National Forest Related | National Forest Percent of Total |
| Agriculture | 3,904 | 291 | 7.5% | 48,092 | 4,927 | 10.2% |
| Mining | 101 | 1 | 1.1% | 2,258 | 38 | 1.7% |
| Utilities | 127 | 3 | 2.6% | 11,803 | 356 | 3.0% |
| Construction | 1,445 | 10 | 0.7% | 42,261 | 378 | 0.9% |
| Manufacturing | 1,875 | 62 | 3.3% | 93,044 | 3,719 | 4.0% |
| Wholesale trade | 412 | 20 | 4.9% | 16,958 | 1,015 | 6.0% |
| Transportation and warehousing | 857 | 26 | 3.0% | 47,114 | 1,283 | 2.7% |
| Retail trade | 3,227 | 87 | 2.7% | 75,029 | 1,971 | 2.6% |
| Information | 291 | 11 | 3.9% | 8,285 | 366 | 4.4% |
| Finance and insurance | 1,039 | 27 | 2.6% | 31,600 | 1,036 | 3.3% |
| Real estate and rental and leasing | 1,044 | 33 | 3.2% | 9,164 | 407 | 4.4% |
| Professional, scientific, and technical services | 1,017 | 42 | 4.1% | 28,293 | 1,461 | 5.2% |
| Management of companies | 104 | 3 | 3.0% | 1,428 | 82 | 5.8% |
| Administrative, waste management, and removal services | 742 | 28 | 3.8% | 9,734 | 452 | 4.6% |
| Educational services | 194 | 6 | 3.4% | 2,608 | 122 | 4.7% |
| Health care and social assistance | 3,378 | 71 | 2.1% | 119,640 | 2,925 | 2.4% |
| Arts, entertainment, and recreation | 411 | 64 | 15.5% | 2,882 | 604 | 20.9% |
| Accommodation and food services | 1,880 | 182 | 9.7% | 27,208 | 2,754 | 10.1% |
| Other services | 1,601 | 31 | 1.9% | 39,101 | 865 | 2.2% |
| Government | 4,345 | 277 | 6.4% | 205,198 | 18,681 | 9.1% |
| Totals | 27,996 | 1,276 | 4.6% | 821,701 | 43,441 | 5.3% |

## Nonuse and Non-Monetary Human Values

The preceding discussion focuses on Forest Service goods and services and uses that can be exchanged in a market place and generate quantitative values measured in jobs and income. Forest Service management activities also result in non-dollar or difficult to measure benefits and costs. These costs and benefits are value changes that can be expressed as increases or decreases in water quality, changes in habitat for wildlife and fish, and reduced risk of large scale fire to name a few. The nonuse and nonmonetary values include: option value for a good or service to be available in the future, such as ecosystem restoration of stream habitat for future fishing options, bequest value from ensuring certain goods and services will be preserved for future generations, and existence value from simply knowing that a certain good or service exists (endangered species protection). These benefits and costs are documented in the other resource qualitative and quantitative discussions and contribute to an overall value determination for each alternative.

### *Social Values*

Throughout the planning process, the public shared information about their uses, interests, and values for the Blue Mountains national forests related to social, economic, and ecological factors. The public provided comments about what uses, benefits, services, or opportunities they wanted and why. Public comments reflect a diverse range of social and economic values. Residents and visitors expressed deeply intertwined relationships between the ecological health of the national forests, their personal enjoyment, lifestyles, customs, culture, and social and economic well-being of communities. They identify diverse connections to and meaning for these connections to the land, (referred to as “sense of place”).

Sense of place describes how individuals or groups identify and value a place. There is a common understanding of how the resources of their place should be managed, and a common understanding of how things are normally done. People’s identification with places sometimes comes from personally interacting with those places and experiencing them with one’s senses. For many people, sense of place is anchored in working in the timber industry or in ranching, restoration, or recreation related jobs on public lands. For others, sense of place involves a hunting camp that is used annually by a group of longtime friends, a rural community that hosts pancake feeds to fund fire protection projects, a grazing allotment dotted with old homestead sites whose natural springs provide water even during droughts, areas that have traditional importance to tribes for gathering, hunting, and spiritual renewal.

Sense of place can also describe an appreciation of and an attachment to a place that has not been experienced first-hand. Examples include people who support conservation efforts but have never visited the place they support conserving. Those who value the existence of cowboys or wilderness areas, but have never encountered them personally, could be described in this category.

A value typology was developed to document and communicate distinct values for the people that commented throughout planning forums. The values represent both tangible and intangible factors. The management activities, uses, and goods and services proposed under the alternatives have a multitude of potential effects on these values depending on who holds the values and where the effect of the alternative is being realized. Individuals and groups often can hold diverse and even conflicting opinions on how their values are affected.

Approximately 1,700 comments were coded using the values identified in the preceding table. A single comment was often assigned to more than one of the values. About 3,800 value statements were generated. The number of comments classified under each value is displayed in figure 9.

The number of comments by category identifies the level of interest in a particular value. It does not imply that any value is more important than another.

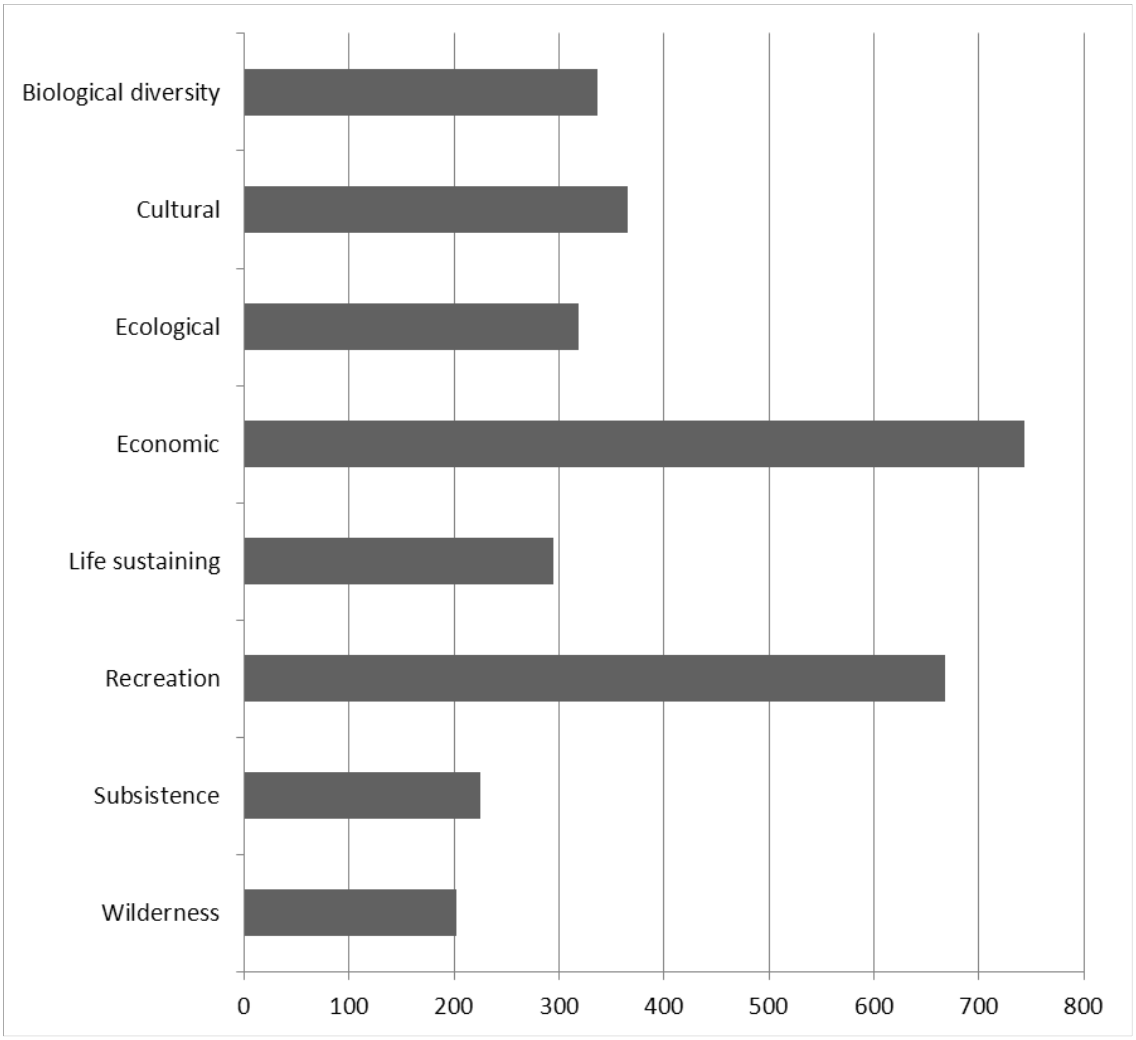


**Figure 9. Comment counts by sense of place values**

In summary, James Kent and Associates characterize the key values expressed by many of the residents of the Blue Mountains area in the following statement:

> The people in the Blue Mountains SRU are extremely outdoor oriented in work and play, linked to the core with grazing, agriculture and timber management. They have created communities which are relatively safe and family-oriented, and which comfortably absorb newcomers who make an effort to fit in. Residents pride themselves on self-sufficiency and interdependence and want government influence to be practical, effective, and minimal. (James Kent and Associates 2006)

Although the statement was specific to residents in a subset of all the counties addressed in the socio-economic impact zones, it generally fits throughout.

## Social and Economic Resilience

The Blue Mountains national forests continue to make contributions to local social and economic systems. Traditional uses center on wood products, livestock forage, and dispersed recreation. Many people depend on the national forests directly or indirectly for a wide range of goods and services and employment opportunities. These include wood for local sawmills and biomass fuel, forage for livestock, water for drinking and irrigation, recreational opportunities, and minerals.

Industries customarily served by agency land uses, such as logging, wood products manufacturing, and livestock grazing, may no longer dictate the economic prosperity of the socio-economic impact zones, but they remain economically and culturally important. The economic dependence of communities on these industries is highest in areas that are geographically isolated with few alternative employment opportunities.

In order to measure and compare the importance of wood products and forage from public lands, a timber and forage importance index was developed in conjunction with the Interior Columbia Basin Ecosystem Management Project (ICBEMP). The index functions on a county level, rather than a socio-economic impact zone level. It consists of five factors: county population change, percent of Forest Service and BLM administered lands in the county, percent of Forest Service and BLM forage and timber supply within the county, and percent of county budget from Federal payments and recreation visits. Table 55 displays qualitative levels of timber/forage dependence as calculated by ICBEMP (USDA and USDI 1996).

**Table 55. Timber/forage dependency (1996)**

| Socio-economic Impact Zone | County | Timber/Forage Dependency Rating |
|---|---|---|
| Malheur | Grant County, OR | High |
| | Harney County, OR | High |
| Umatilla | Grant County, OR | High |
| | Morrow County, OR | Medium high |
| | Umatilla County, OR | Medium high |
| | Union County, OR | High |
| | Wallowa County, OR | High |
| | Wheeler County, OR | Medium high |
| | Asotin County, WA | Medium high |
| | Columbia County, WA | Medium high |
| | Garfield County, WA | Medium high |
| | Walla Walla County, WA | Low |
| | Nez Perce County, ID | Medium high |
| Wallowa-Whitman | Baker County, OR | High |
| | Union County, OR | Medium high |
| | Wallowa County, OR | High |

Most of the counties in the three socio-economic impact zones have medium high to high timber forage dependency ratings. In general, counties with a higher dependency on timber and forage have lower socio-economic resiliency, which is the ability to adapt to social and economic change. The potential for low resiliency in the Malheur and Wallowa-Whitman socio-economic impact zones is also shown in the negative population growth rates and declining working age population components in these socio-economic impact zones.

A predictable and steady flow of goods and services from national forests helps to sustain the worker skill base and infrastructure supporting work within the national forests. Producing predictable and sufficient timber volume from National Forest System lands has become increasingly difficult. Natural disturbances, such as wind storms, wildfires, and insects and disease disturbances, can change the amount and rate of timber volume that can be offered for sale. Market conditions affect the flow of goods and services. The recent national economic recession has caused wood product prices to drop. As a result, some timber sales on the Blue Mountains national forests received no bids and were not sold. Changing Forest Service policy, law, and national budget priorities also affect the flow of goods and services.

### *Malheur Socio-economic Impact Zone*

The Malheur socio-economic impact zone has a number of indicators showing a potential for low resiliency. The population is declining overall, as is the workforce. The median age is 48, and the population density is one person per square mile. Most of the residents are classified as rural. Poverty in the socio-economic impact zone is approaching 18 percent, and it has a low percentage of residents with higher education degrees. The Malheur socio-economic impact zone has a low per capita income that is more than 20 percent lower than the Oregon average. The economy is dominated by the government sector, and it has an economic diversity index of 0.58 compared to the Oregon index of 0.75. Current unemployment levels are 14 percent, about three percent higher than Oregon data.

Harney and Grant counties have comparatively low populations, are geographically isolated, and their social and economic systems traditionally have been natural resource dependent. Both counties were given low socio-economic resiliency ratings in an assessment completed for ICBEMP (Horne and Haynes 1999). Job losses have cut across many industries. Since 1990, three sawmills have closed, and several logging companies have either left the area or have gone out of business.

Many people working in the timber industry are adapting their skills and infrastructure to support a restoration-based economy. Work associated with this economy includes tree thinning, culvert removal, and watershed restoration. A biomass facility is being constructed in Grant County. It will use noncommercial logs being removed in restoration-focused projects. The one remaining sawmill remains viable by producing special order products for individual customers. There are community concerns about whether the quantity and flow of forest products will be enough to sustain local businesses.

### *Umatilla Socio-economic Impact Zone*

Encompassing the largest geographic area, the Umatilla socio-economic impact zone has the largest population and has experienced the most population growth. Collectively, the Umatilla socio-economic impact zone indicators more closely resemble Oregon data. However, data for individual counties show a more complicated picture. The population is gradually growing overall with increases in the more urban counties: Umatilla, Nez Perce, and Walla Walla. Most of the remaining counties show population increases and decreases of five percent or less, except for Wheeler and Garfield counties, with population decreases of 12 percent during the last decade. The population density is about 11 people per square mile. The median age is 40, and most of the population is classified as urban. Per capita income in the socio-economic impact zone is higher than the average for all Oregon non-metropolitan counties, and poverty levels overall are close to the Oregon statewide average. The socio-economic impact zone’s economic diversity index is 0.71. The unemployment rate in this socio-economic impact zone is about nine percent, which is less than the Oregon statewide non-metropolitan average.

Viewed at the broader socio-economic impact zone scale, this area has the highest level of socio-economic resiliency. The most populous counties within the socio-economic impact zone are Walla Walla, Umatilla, and Nez Perce, all of which were labeled highly resilient in the ICBEMP assessment (Horne and Haynes 1999). Economies of these urban counties are not likely to be strongly affected by Forest Service management decisions. However, other counties within the socio-economic impact zone and some communities within the highly resilient counties are more sparsely populated and have fewer economic opportunities. These places are often more dependent on natural resource-related revenues.

#### *Wallowa-Whitman Socio-economic Impact Zone*

The indicators of resiliency for the Wallowa-Whitman socio-economic impact zone generally fall between the Malheur and the Umatilla socio-economic impact zones' data. There was an overall population decline with Baker and Wallowa counties, declining four and five percent respectively, while Union County population increased by two percent. The median age of the socio-economic impact zone is 44, and the population density is six people per square mile. Per capita income closely resembles the data for all Oregon non-metropolitan counties, and poverty levels are similar to the high levels in the Malheur socio-economic impact zone. The economic diversity index for the Wallowa-Whitman socio-economic impact zone is 0.69. Unemployment is slightly greater than 10 percent.

The economy is smaller and less diversified than that of the Umatilla socio-economic impact zone; however, it includes advanced education opportunities that include a university and a growing service sector. There are several manufacturing businesses in diversified sectors, including two recreational trailer plants, sawmill and plywood plants and a particle board plant. Since 1990, two biomass-focused operations have opened and four sawmills have closed.

Overall, the socio-economic impact zone has medium socio-economic resiliency. However, Wallowa County is isolated, has a small population, and logging and grazing traditionally have been key components of the economy. The ICBEMP assessment gave Wallowa County a low socio-economic resiliency rating; towns within the county have had difficulty retaining physical and community infrastructure, such as sawmills and community volunteers.

## Environmental Consequences – Economic and Social Well-being

The following discussion describes the potential direct, indirect, and cumulative effects on social and economic well-being for each alternative. The social and economic issue is evaluated using the key indicators identified in chapter 1. The evaluation of effects focuses on the economic contribution of the alternatives on local economies, the effect of changes in management activities on goods and services, and the resulting impacts on users and their values. The indicators include acres suitable for timber production, estimated timber harvest volume, grazing use, and employment and income contributions. The employment and income contributions are measured for recreation, range, timber, budgets, and revenue sharing and payments to counties. Impacts to non-use and nonmarket values are also discussed.

### Key Indicators of Social and Economic Contributions to Well-being

#### *Recreation*

For all alternatives, the quantity of recreation visits, including wildlife-related recreation, and local visits, to the national forests is not expected to vary from current use levels. The current supply of recreational opportunities is expected to exceed demand for the foreseeable future. Therefore there is no estimated change to the overall level of recreation related expenditures, so no change is estimated for jobs and income supported by these expenditures (see table 56). It is possible that use patterns may change within a socio-economic impact zone due to changes in access and use patterns, causing localized economic impacts. However, that level of scale is not addressed in this forestwide evaluation.

**Table 56. Estimated jobs and income supported by recreation to counties by alternative**

| National Forest | Estimated Related Employment Contribution | | | | | |
|---|---|---|---|---|---|---|
| | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** | **Alt. E** | **Alt. F** |
| MAL | 233 | 233 | 233 | 233 | 233 | 233 |
| UMA | 187 | 187 | 187 | 187 | 187 | 187 |
| WAW | 397 | 397 | 397 | 397 | 397 | 397 |
| **National Forest** | **Estimated Related Wage Income Contribution ($1,000)** | | | | | |
| | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** | **Alt. E** | **Alt. F** |
| MAL | $4,589 | $4,589 | $4,589 | $4,589 | $4,589 | $4,589 |
| UMA | $4,527 | $4,527 | $4,527 | $4,527 | $4,527 | $4,527 |
| WAW | $7,678 | $7,678 | $7,678 | $7,678 | $7,678 | $7,678 |

Livestock grazing and rangeland vegetation

Estimates of permitted cattle and sheep grazing are used to generate the economic effects of the alternatives. Permitted grazing use rather than authorized use is evaluated because it represents the strategic intent of the alternatives. The grazing economic impacts may be overestimated.

The projected amounts of permitted cattle grazing are displayed in table 57. The amount of cattle grazing within each national forest would be generally the same for alternatives A, B, D, E, and F. The amount of forage available for sheep would vary across alternatives A, B and C. Sheep grazing levels for alternatives D, E and F are the same for each national forest. Alternative C would provide the least amount of forage available to cattle and sheep on each national forest.

**Table 57. Estimated cattle and sheep permitted animal unit months (AUMs) by alternative**

| National Forest | Estimated Cattle AUMs (permitted) | | | | | |
|---|---|---|---|---|---|---|
| | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** | **Alt. E** | **Alt. F** |
| MAL | 117,000 | 120,000 | 61,000 | 119,000 | 117,000 | 117,000 |
| UMA | 30,000 | 31,000 | 3,000 | 30,000 | 30,000 | 30,000 |
| WAW | 77,000 | 74,000 | 26,000 | 80,000 | 77,000 | 77,000 |
| **National Forest** | **Estimated Sheep AUMs (permitted)** | | | | | |
| | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** | **Alt. E** | **Alt. F** |
| MAL | 6,500 | 6,500 | 1,200 | 6,500 | 6,500 | 6,500 |
| UMA | 7,800 | 4,600 | 1,200 | 4,600 | 4,600 | 4,600 |
| WAW | 4,500 | 3,500 | 3,500 | 4,500 | 4,500 | 4,500 |

The total of direct, indirect, and induced jobs and wage income including estimates for unpaid or family labor contributions supported by permitted cattle and sheep grazing are displayed in table 58 by national forest and by alternative. The results are consistent with the alternative estimates of permitted forage. Alternative C would support the least amount of jobs and income. The rest of the alternatives would support plus or minus 10 percent of the jobs and income supported by alternative B except for alternative A on the Umatilla, which is about 20 percent higher.

**Table 58. Estimated jobs and income supported by grazing by alternative**

| National Forest | Estimated Grazing Related Employment Contribution | | | | | |
|---|---|---|---|---|---|---|
| | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
| MAL | 389 | 398 | 187 | 439 | 395 | 389 |
| UMA | 153 | 130 | 19 | 127 | 127 | 127 |
| WAW | 258 | 242 | 102 | 267 | 258 | 258 |
| **National Forest** | **Estimated Grazing Related Wage Income Contribution ($1,000)** | | | | | |
| | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** | **Alt. E** | **Alt. F** |
| MAL | $5,195 | $5,316 | $2,550 | $5,881 | $5,276 | $5,195 |
| UMA | $1,874 | $1,674 | $219 | $1,631 | $1,631 | $1,631 |
| WAW | $3,435 | $3,241 | $1,304 | $3,556 | $3,435 | $3,435 |

### *Timber (Including Fuelwood)*

The predicted levels of timber harvest are used to estimate the amount of economic activity for each alternative. The harvest amounts are mostly made up of sawtimber and non-sawtimber, such as pulpwood and biomass and fuelwood (see table 59). Smaller amounts of posts and poles, which are harvested mostly for personal use, are also included. The posts, poles, and fuelwood amounts are not predicted to vary by alternative.

**Table 59. Estimated timber harvest by alternative (CCF)**

| Timber Product | Estimated Timber Harvest (CCF) | | | | | |
|---|---|---|---|---|---|---|
| | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
| **Malheur** | | | | | | |
| Sawtimber | 40,060 | 42,620 | 20,100 | 126,000 | 79,060 | 51,320 |
| Non-sawtimber | 15,905 | 16,929 | 7,976 | 50,000 | 31,381 | 20,381 |
| Fuelwood | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 |
| Other | 181 | 181 | 181 | 181 | 181 | 181 |
| Totals | 62,146 | 65,730 | 34,257 | 182,181 | 116,622 | 77,882 |
| **Umatilla** | | | | | | |
| Sawtimber | 33,300 | 36,000 | 16,060 | 106,520 | 76,960 | 46,520 |
| Non-sawtimber | 13,214 | 14,286 | 6,381 | 42,286 | 30,548 | 18,476 |
| Fuelwood | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| Other | 151 | 151 | 151 | 151 | 151 | 151 |
| Totals | 56,665 | 60,437 | 32,592 | 158,957 | 117,659 | 75,147 |
| **Wallowa-Whitman** | | | | | | |
| Sawtimber | 26,260 | 31,960 | 13,520 | 110,400 | 66,160 | 41,860 |
| Non-sawtimber | 10,400 | 12,690 | 5,381 | 43,810 | 26,262 | 16,619 |
| Fuelwood | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 |
| Other | 0 | 0 | 0 | 0 | 0 | 0 |
| Totals | 48,660 | 56,650 | 30,901 | 166,210 | 104,422 | 70,479 |

Timber harvest levels would vary with the amount of acres suitable for timber production (see table 60) and the emphasis on timber production versus ecosystem restoration. A timber production emphasis focuses more on the production of saw logs. Alternative D, with an emphasis on high levels of sawtimber production, requires the most suitable acres and would have the greatest timber production level. The proportion of sawtimber harvest compared to total harvest would also be greatest in alternative D. Conversely, alternative C, with a decreased emphasis on timber harvest, would have the fewest suitable acres. The rest of the alternatives would have the same suitable acres base, but emphasis on timber production would differ so that the total amount of harvest, sawtimber, and non-sawtimber would vary.

**Table 60. Acres suitable for timber production by alternative**

| National Forest | Acres Suitable for Timber Production | | | | | |
|---|---|---|---|---|---|---|
| | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
| MAL | NA | 770,000 | 530,000 | 1,080,000 | 770,000 | 770,000 |
| UMA | NA | 420,000 | 260,000 | 610,000 | 420,000 | 420,000 |
| WAW | NA | 530,000 | 310,000 | 770,000 | 530,000 | 530,000 |

Employment and income by alternative is based on the harvest level by product type displayed in table 59. The estimated timber related economic effects are displayed in table 61. The timber production emphasis of alternative D would result in a job contribution more than three times the level of employment of alternative A for the Malheur and Umatilla National Forests and four times the level of employment of alternative A for the Wallowa-Whitman National Forest (see table 62). Timber harvest related employment under alternative C would be about one-half of the level for alternative A across all three national forests. The rest of the alternatives compared to alternative A and ranked in declining order are alternative E, F, and B for all three national forests.

**Table 61. Estimated jobs and income supported by timber harvest by alternative**

| National Forest | Estimated Timber Harvest Related Employment Contribution | | | | | |
|---|---|---|---|---|---|---|
| | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
| MAL | 133 | 142 | 67 | 418 | 263 | 170 |
| UMA | 243 | 263 | 117 | 777 | 561 | 339 |
| WAW | 201 | 245 | 104 | 845 | 506 | 320 |
| **National Forest** | **Estimated Timber Harvest Related Wage Income Contribution ($1,000)** | | | | | |
| | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** | **Alt. E** | **Alt. F** |
| MAL | $7,214 | $7,674 | $3,625 | $22,660 | $14,224 | $9,238 |
| UMA | $13,882 | $15,006 | $6,707 | $44,365 | $32,058 | $19,388 |
| WAW | $11,112 | $13,526 | $5,723 | $46,722 | $28,000 | $17,716 |

**Table 62. Estimated jobs and income by alternative compared to alternative A**

| National Forest | Percent of Alternative A Employment | | | | | |
|---|---|---|---|---|---|---|
| | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
| MAL | 100% | 107% | 50% | 314% | 198% | 128% |
| UMA | 100% | 108% | 48% | 320% | 231% | 140% |
| WAW | 100% | 122% | 52% | 420% | 252% | 159% |

### *Expenditures (Salary and Non-salary)*

The national forest budgets are made up of salary and non-salary expenditures. Non-salary expenditures are the purchases of goods and services, including contracting for restoration activities, and are for acquiring and maintaining facilities and other infrastructure. The type and amount of management activities needed to achieve the desired conditions within the specified time period would require changes in budgets for alternatives D, E, and F (see table 63). The budget increases would be divided into salary and non-salary components with the salary expenditure receiving less of the budget increase. Salary expenditure receives less of the budget increase because it is not necessary to add Forest Service positions for management and for staffing to areas where there are no budget increases.

**Table 63. Estimated budget expenditures by alternative**

| National Forest | Estimated Budget Expenditures (salary and non-salary) ($1,000) | | | | | |
|---|---|---|---|---|---|---|
| | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** | **Alt. E** | **Alt. F** |
| MAL | $19,200 | $19,200 | $17,162 | $23,514 | $20,472 | $18,701 |
| UMA | $19,331 | $19,331 | $17,936 | $24,209 | $21,277 | $19,296 |
| WAW | $22,900 | $22,900 | $20,616 | $27,776 | $24,031 | $221,158 |

The job and income effects of the total budgets are displayed in table 64. The job and income changes by alternative would be consistent with the budget increases and decreases. Alternative D would support the most jobs and labor income at about 20 percent greater than alternative A. Alternative C supports the lowest jobs and income levels at about 5 to 10 percent less than alternative A.

**Table 64. Estimated jobs and income supported by total budget expenditures by alternative**

| National Forest | Estimated Budget Expenditures Related Employment Contribution | | | | | |
|---|---|---|---|---|---|---|
| | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** | **Alt. E** | **Alt. F** |
| MAL | 362 | 362 | 331 | 428 | 382 | 355 |
| UMA | 393 | 393 | 370 | 470 | 424 | 392 |
| WAW | 466 | 466 | 429 | 545 | 484 | 454 |
| **National Forest** | **Estimated Budget Expenditures Related Wage Income Contribution ($1,000)** | | | | | |
| | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** | **Alt. E** | **Alt. F** |
| MAL | $17,179 | $17,179 | $15,915 | $19,852 | $17,967 | $16,869 |
| UMA | $19,215 | $19,215 | $18,217 | $22,706 | $20,607 | $19,190 |
| WAW | $22,766 | $22,766 | $21,166 | $26,181 | $23,558 | $22,245 |

Forest Service employment currently accounts for about 60 percent of the jobs and income associated with budget expenditures. Restoration work supported by budgets is the next largest component of all jobs and income supported by budgets. Restoration work includes restoring existing ecosystem conditions to meet alternative desired conditions as well as maintaining and protecting existing desired conditions. Table 65 displays how employment and income supported by restoration work would differ by alternative. Restoration activities within the national forests currently support about 20 percent of all budget related jobs. Under alternative C, active restoration activities and the supported jobs and income would decrease by about 40 percent on the Malheur and Wallowa-Whitman National Forests and by 25 percent on the Umatilla. Under alternative D, restoration supported jobs and income would increase by 85 to 95 percent across the national forests. Alternative E would result in additional restoration jobs and income varying between 20 to 35 percent compared to alternative A across the national forests.

**Table 65. Estimated jobs and income supported by restoration related expenditures by alternative**

| National Forest | Estimated Restoration Related Employment Contribution | | | | | |
|---|---|---|---|---|---|---|
| | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** | **Alt. E** | **Alt. F** |
| MAL | 68 | 68 | 41 | 125 | 85 | 62 |
| UMA | 75 | 75 | 56 | 143 | 102 | 75 |
| WAW | 81 | 81 | 45 | 156 | 98 | 69 |
| **National Forest** | **Estimated Restoration Related Wage Income Contribution ($1,000)** | | | | | |
| | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** | **Alt. E** | **Alt. F** |
| MAL | $2,066 | $2,066 | $1,252 | $3,790 | $2,575 | $1,867 |
| UMA | $2,907 | $2,907 | $2,163 | $5,511 | $3,946 | $2,889 |
| WAW | $2,582 | $2,582 | $1,449 | $5,001 | $3,143 | $2,215 |

### *Revenue Sharing and Payments to Counties*

SRS payments used for revenue sharing are divided into three separate parts. Title 1 money, about 80 percent of the total, is spent on local roads and schools. The split of Title 1 money between roads and schools in Oregon is 75:25 with roads getting the larger share. The percentage split of Title 1 money is 50:50 in Washington and Idaho. The remaining SRS payment is spent on ecosystem management projects on National Forest System lands and on local government projects enhancing environmental education, public safety, and other projects. PILT money can be spent on any local government purpose (see table 66).

**Table 66. Total Forest Service payments based on Secure Rural Schools to socio-economic impact zones for 2009**

| Payment Type | Socio-economic Impact Zone | | |
|---|---|---|---|
| | **Malheur** | **Umatilla** | **Wallowa-Whitman** |
| SRS | $7,900,754 | $3,151,705 | $2,714,318 |
| PILT | $453,467 | $745,694 | $1,157,956 |
| Totals | $8,354,221 | $3,897,399 | $3,872,274 |

Table 67 displays the expected jobs and income by national forest. Although there will be future variations in payments based on the PILT and SRS payments formulas, these variances are not caused by differences in the alternatives. Therefore, the payment dollars are not projected to vary by alternative while the SRS payments are in place.

If the SRS payments cease, revenues to the socio-economic impact zones and the jobs and income those dollars support will be based on national forest revenues. Based on the 2007 receipt data, payments would be much less than dollars received under the SRS payments (table 68). These dollars are split between local roads and schools with a 50:50 split in Washington and Idaho and 75 percent going to local roads in Oregon.

**Table 67. Estimated jobs and income supported by receipt-based payments to counties by alternative**

| National Forest | Estimated Related Employment Contribution | | | | | |
|---|---|---|---|---|---|---|
| | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
| MAL | 139 | 139 | 139 | 139 | 139 | 139 |
| UMA | 68 | 68 | 68 | 68 | 68 | 68 |
| WAW | 72 | 72 | 72 | 72 | 72 | 72 |
| **National Forest** | **Estimated Related Wage Income Contribution ($1,000)** | | | | | |
| | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** | **Alt. E** | **Alt. F** |
| MAL | $4,479 | $4,479 | $4,479 | $4,479 | $4,479 | $4,479 |
| UMA | $2,574 | $2,574 | $2,574 | $2,574 | $2,574 | $2,574 |
| WAW | $2,389 | $2,389 | $2,389 | $2,389 | $2,389 | $2,389 |

**Table 68. Reconstructed Forest Service 25-percent and PILT payments to socio-economic impact zones (2007)**

| Payment Type | Socio-economic Impact Zone | | |
|---|---|---|---|
| | Malheur | Umatilla | Wallowa-Whitman |
| 25-percent (reconstructed data) | $294,487 | $475,001 | $182,314 |

The receipts based payments will vary by alternative and support different levels of jobs and income (see table 69). Alternatives producing more revenue generating outputs and uses will in turn provide larger payments to counties. Differences in payments are primarily related to the amount and value of commercial wood products available by alternative. Although PILT payments are inversely related to revenue sharing payments such that a decrease in revenue sharing payments would be offset by slightly higher PILT dollars, the data to estimate the change in PILT payments are not available. PILT payment data for 2009 are used as a proxy. Alternative C supports the least jobs and income based on lower payments to counties due to decreased timber harvest and alternative D the most.

**Table 69. Estimated jobs and income supported by revenue sharing and payments to counties by alternative**

| National Forest | Estimated Related Employment Contribution | | | | | |
|---|---|---|---|---|---|---|
| | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
| MAL | 13 | 13 | 11 | 19 | 16 | 14 |
| UMA | 20 | 21 | 18 | 32 | 27 | 23 |
| WAW | 25 | 25 | 24 | 29 | 27 | 26 |
| **National Forest** | **Estimated Related Wage Income Contribution ($1,000)** | | | | | |
| | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** | **Alt. E** | **Alt. F** |
| MAL | $454 | $457 | $404 | $658 | $547 | $479 |
| UMA | $830 | $849 | $726 | $1,294 | $1,104 | $915 |
| WAW | $932 | $939 | $908 | $1,076 | $999 | $957 |

### *Social Values*

People and their values are complex. Individual or group values are affected in a multitude of ways by an alternative overall and by specific parts of an alternative. A person may like the general intent of an alternative and dislike a particular activity at a particular place. Given the strategic nature of the forest plans, an evaluation about how alternatives affect social values is focused on a forestwide perspective across all three national forests. At this scale, it is not possible to identify unique places or how individuals value those places. However, an evaluation of the overall intent of the alternatives can be made.

The discussion centers on those values that show the highest levels of interest with generally 200 or more comments. These high interest values are presented in figure 10. The identification of alternative effects on each value is accomplished using resource and socioeconomic indicators described in preceding sections. For ease of reading, tables of the indicators are used again in this section (James Kent and Associates 2006). For a more complete explanation of the value typology, see the section titled “Nonuse and Non-monetary Human Values” above.

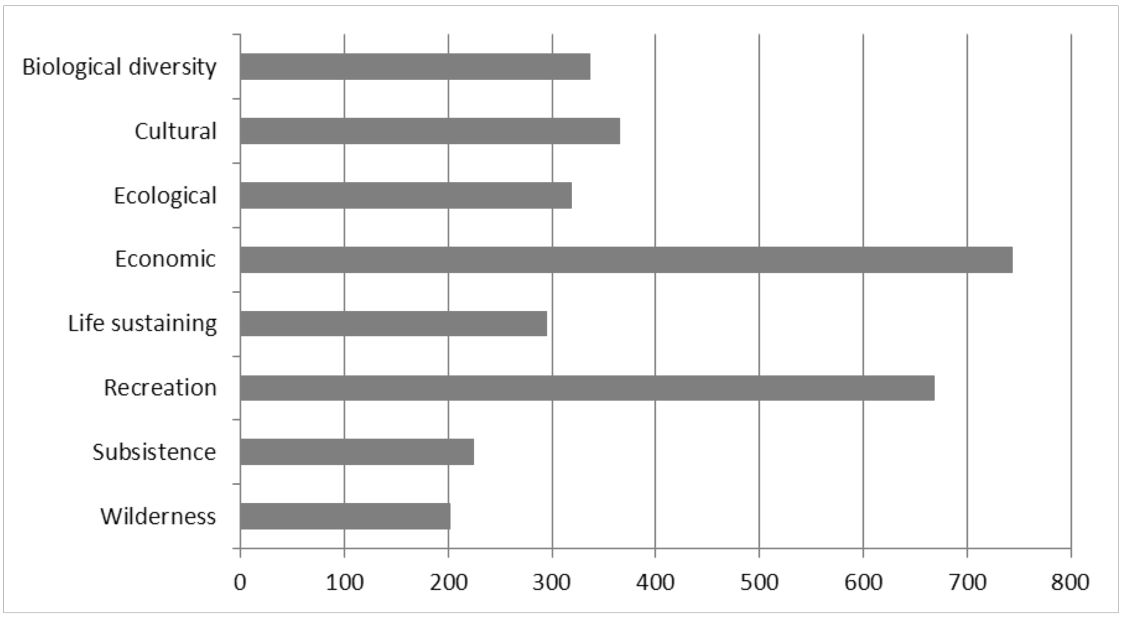


**Figure 10. High interest sense of place values**

Biological diversity is described as valuing places because they provide a variety of fish, wildlife, and/or plants. Ecological values are described as valuing places because they are ecologically functional and healthy. Life sustaining values are identified as valuing places because they help produce, preserve, and renew air, soil, and water. Alternative impacts on all three of these values are measured using the condition class score. The condition class indicator shows the movement toward historic conditions, and larger changes results in the greatest movement toward historic conditions. Historic conditions are expected to provide high levels of naturally occurring biological diversity, and to provide the highest levels of functional and healthy ecosystems. Alternative D would have the most movement towards the historic conditions for dry and moist forests, and alternative B for cold forest (see table 70).

**Table 70. Condition class score by vegetation type for all three national forests**

| National Forest | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| Cold forest | 61% | 54% | 63% | 61% | 61% | 63% |
| Dry forest | 11% | 14% | 10% | 24% | 19% | 14% |
| Moist forest | 36% | 39% | 33% | 53% | 44% | 36% |

In addition to condition class score, alternative impacts to ecological values are also indicated by restoration activities including acres of fuel treatments, miles of stream restoration, and acres of riparian and wetlands enhancement.

Cultural values are described as valuing places because they are important to maintain and are used to pass down the wisdom, knowledge, traditions, and cultural ways of life. Subsistence values are described as valuing places because they provide important food, firewood, and other supplies that sustain life. These two values are combined because they both reveal that the people in the Blue Mountains area “are outdoor oriented in work and play, linked to the core with grazing, agriculture and timber management” (James Kent and Associates 2006).

Alternative impacts on these values are described using the percent of the national forest available for summer motor vehicle use (see table 71) and acres of vegetation management activities for fuel treatments and timber harvest (see table 72). Motor vehicle access is used because gathering food, firewood and other supplies and reaching important places are facilitated by access. Acres of vegetation management are used because firewood gathering is often a side product of vegetation management activities. Vegetation management also often enhances habitat for large vertebrate species, such as deer and elk.

**Table 71. Percent of national forest suitable for summer motor vehicle use**

| National Forest | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| MAL | 83% | 85% | 51% | 93% | 90% | 90% |
| UMA | 66% | 71% | 36% | 73% | 63% | 63% |
| WAW | 75% | 74% | 35% | 75% | 68% | 68% |

**Table 72. Acres of timber harvest annually by national forest**

| National Forest | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| MAL | 7,100 | 7,100 | 3,400 | 20,500 | 12,500 | 8,300 |
| UMA | 5,200 | 5,100 | 2,300 | 15,600 | 10,600 | 6,400 |
| WAW | 4,500 | 4,550 | 2,050 | 16,250 | 9,350 | 6,050 |

Economic values are described as valuing places for the economic benefits they provide, such as timber, fisheries, minerals, or tourism opportunities. The indicator to show the alternative impacts on economic values is employment supported by the national forest programs (see table 73). Alternative D would support the most jobs and alternative C the least.

**Table 73. Total direct, indirect, and induced employment contribution by national forest (jobs)**

| National Forest | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| MAL | 1,257 | 1,274 | 956 | 1,657 | 1,412 | 1,287 |
| UMA | 1,044 | 1,041 | 762 | 1,629 | 1,368 | 1,114 |
| WAW | 1,395 | 1,422 | 1,104 | 2,126 | 1,718 | 1,502 |

Recreation values are described as the valuing of places because they provide outdoor recreation opportunities. Developed recreation opportunities are not expected to change across alternatives so the indicator for alternative effects on recreation values is the mix of motor vehicle and nonmotorized access, which is indicated by the amount of area suitable for each use. Table 71 displays the percent of each national forest available for summer motor vehicle use. The rest of the national forest is suitable only for nonmotorized use (summer). Shifts between these two categories by alternative would both positively and negatively affect recreation values depending on a person's preferred experiences. The impact is not the same for motor vehicle users and nonmotorized users. A five percent increase or decrease in area suitable for motor vehicle use can result in a much larger change in area available only for nonmotorized use. For example, for the Malheur National Forest, alternatives D, E, and F would provide about 10 percent more area for summer motor vehicle use than alternative A. The corresponding decrease in area for only summer nonmotorized use is greater than 50 percent. For alternative C within the Malheur National Forest, the area available for summer motor vehicle use would decrease almost 40 percent compared to alternative A. This would result in a corresponding increase in area available only for nonmotorized use of 190 percent. Evaluating the alternative effects on recreation values is complex and presents conflicting results.

People often value most the recreation experiences currently available to them. The alternatives that result in the greatest change from current motor vehicle and nonmotorized availability are likely to generate the most negative effects on recreation values. For all three national forests, alternative C would generate the greatest declines in the availability of area for motor vehicle use, and alternative D would have the greatest increase in area suitable for motor vehicle use with the Malheur and Umatilla National Forests.

Wilderness values are describes as the valuing of places because they provide unmanaged, pristine, unroaded areas. Alternative impacts on these values are described using the acres allocated to preliminary administratively recommended wilderness areas (see table 74) and acres allocated to MA 3A Backcountry (nonmotorized use) (see table 75). These two indicators show the same relative alternative effects on wilderness values with alternative C providing the most acres to management emphasis that provide generally unmanaged pristine areas. Alternatives E and F rank second for positive impact on wilderness values.

**Table 74. Preliminary administratively recommended wilderness areas (acres)**

| National Forest | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| MAL | 0 | 1,200 | 83,800 | 0 | 30,400 | 30,400 |
| UMA | 0 | 1,400 | 248,500 | 0 | 40,100 | 40,100 |
| WAW | 0 | 10,800 | 172,700 | 0 | 20,300 | 20,300 |

**Table 75. Backcountry nonmotorized use (acres)**

| National Forest | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| MAL | 0 | 59,300 | 270,400 | 0 | 53,600 | 53,600 |
| UMA | 0 | 19,300 | 105,800 | 0 | 105,500 | 105,500 |
| WAW | 0 | 0 | 210,100 | 0 | 104,400 | 104,400 |

### *Resilience and Social and Economic Well-being Summary*

Changes in forest management can affect traditions, lifestyles, and the economic livelihood of residents and communities. Those who depend on the national forests for their livelihoods and recreation opportunities are concerned that their relationship with the national forests may be compromised by other uses and restrictions. Forest Service managers depend on their relationships with local communities, people and their institutions to help administer the national forests by providing a skilled workforce, labor, manufacturing infrastructure, business support, and other services cost effectively. All of these relationships are important to sustaining and restoring the ecological integrity of the national forests as well as the social and economic conditions of the communities.

The following sections describe how alternative levels of Forest Service contributed employment may cumulatively affect each of the three socio-economic impact zones.

## Cumulative Effects on the Malheur Socio-economic Impact Zone

The jobs and income supported through national forest management activities are very important components of the Malheur socio-economic impact zone's socio-economic well-being. The Forest Service currently contributes over 15 percent of the total employment and labor income in the impact zone. Compared to alternative A, the overall jobs contribution would decrease by about 25 percent under alternative C and would increase by about 30 percent for alternative D. Alternative E would be the second highest with an increase close to 10 percent. These changes are driven by the differences in Forest Service expenditures on contractors and supplies associated with ecosystem restoration management activities, timber harvest, and livestock grazing (table 76).

Given the relatively low socio-economic resiliency of the Malheur socio-economic impact zone, the declines in employment and income projected for alternative C may have a measurable negative effect on community well-being. The declines in timber harvest may make it difficult to maintain wood products manufacturing infrastructure in the Malheur socio-economic impact zone. Projections of timber harvest on other ownerships in eastern Oregon do not indicate the potential to replace national forest timber harvest given current costs and stumpage prices (Adams and Latta 2007). The higher levels of timber harvest and resulting employment under alternative D and E may be enough to support existing and possibly expand wood manufacturing infrastructure.

**Table 76. Total jobs and income supported by national forest activities and programs by alternative for the Malheur socio-economic impact zone**

| Activity | Estimated Employment Contribution (direct, indirect, and induced) | | | | | |
|---|---|---|---|---|---|---|
| | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
| Recreation | 233 | 233 | 233 | 233 | 233 | 233 |
| Range | 389 | 398 | 187 | 439 | 395 | 389 |
| Timber | 133 | 142 | 67 | 418 | 263 | 170 |
| Expenditures | 362 | 362 | 331 | 428 | 382 | 355 |
| County payments | 139 | 139 | 139 | 139 | 139 | 139 |
| **Totals** | **1,257** | **1,274** | **956** | **1,657** | **1,412** | **1,287** |
| **Activity** | **Estimated Wage Income Contribution (direct, indirect, and induced)** | | | | | |
| | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** | **Alt. E** | **Alt. F** |
| Recreation | $4,589 | $4,589 | $4,589 | $4,589 | $4,589 | $4,589 |
| Range | $5,195 | $5,316 | $2,550 | $5,881 | $5,276 | $5,195 |
| Timber | $7,214 | $7,674 | $3,625 | $22,660 | $14,224 | $9,238 |
| Expenditures | $17,179 | $17,179 | $15,915 | $19,852 | $17,967 | $16,869 |
| County payments | $4,479 | $4,479 | $4,479 | $4,479 | $4,479 | $4,479 |
| **Totals** | **$38,655** | **$39,237** | **$31,158** | **$57,462** | **$46,534** | **$40,370** |

## Cumulative Effects on the Umatilla Socio-economic Impact Zone

The Forest Service contributes about one percent of the total employment and labor income in the Umatilla socio-economic impact zone. The employment contribution would decrease by about 25 percent for alternative C and would increase by about 55 percent for alternative D. Alternative E would be the second highest with an increase of close to 30 percent. These changes are primarily driven by the differences in Forest Service expenditures on contractors and supplies associated with ecosystem restoration management activities, livestock grazing, and timber harvest (table 77).

The large area encompassed by the Umatilla socio-economic impact zone along with the high population centers and a diversified economy provides the area with a relatively high socio-economic resiliency. The declines in jobs projected for alternative C would have a much smaller impact on the economy overall. However, individual businesses and workers will be affected. The projected increase in jobs associated with the increased timber harvest and Forest Service employment for alternatives D and E would expand the Forest Service contribution to the total employment to about one percent. The increase in timber harvest can contribute to the maintenance and expansion of wood products manufacturing infrastructure.

**Table 77. Total jobs and income supported by national forest activities and programs by alternative for the Umatilla socio-economic impact zone**

| Activity | Estimated Employment Contribution (direct, indirect, and induced) | | | | | |
|---|---|---|---|---|---|---|
| | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** | **Alt. E** | **Alt. F** |
| Recreation | 187 | 187 | 187 | 187 | 187 | 187 |
| Range | 153 | 130 | 19 | 127 | 127 | 127 |
| Timber | 243 | 263 | 117 | 777 | 561 | 339 |
| Expenditures | 393 | 393 | 370 | 470 | 424 | 392 |
| County payments | 68 | 68 | 68 | 68 | 68 | 68 |
| **Totals** | **1,044** | **1,041** | **762** | **1,629** | **1,368** | **1,114** |
| **Activity** | **Estimated Wage Income Contribution (direct, indirect, and induced)** | | | | | |
| | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** | **Alt. E** | **Alt. F** |
| Recreation | $4,527 | $4,527 | $4,527 | $4,527 | $4,527 | $4,527 |
| Range | $1,874 | $1,674 | $219 | $1,631 | $1,631 | $1,631 |
| Timber | $13,882 | $15,006 | $6,707 | $44,365 | $32,058 | $19,388 |
| Expenditures | $19,215 | $19,215 | $18,217 | $22,706 | $20,607 | $19,190 |
| County payments | $2,574 | $2,574 | $2,574 | $2,574 | $2,574 | $2,574 |
| **Totals** | **$42,072** | **$42,996** | **$32,244** | **$75,802** | **$61,397** | **$47,310** |

## Cumulative Effects on the Wallowa-Whitman Socio-economic Impact Zone

The Forest Service has moderate economic ties to the Wallowa-Whitman socio-economic impact zone with about five percent contributions to total employment and labor income. The jobs and income supported through Forest Service activities are moderately important components of the Wallowa-Whitman socio-economic impact zone's socio-economic well-being. This job contribution would decrease by 20 percent for alternative C, and would increase by close to 50 percent for alternative D. Alternative E would be the second highest with a projected increase of about 20 percent. These changes are primarily driven by the differences in Forest Service contractors and supplies for ecosystem restoration management activities, livestock grazing, and timber harvest (table 78).

The Wallowa-Whitman socio-economic impact zone resilience ranks in between the Malheur and Umatilla socio-economic impact zones. The projected decline in jobs for alternative C would have a moderate impact on the economy overall and especially in the timber related components. Projections of timber harvests on other ownerships in eastern Oregon do not indicate the potential to replace national forest timber harvest given current costs and stumpage prices (Adams and Latta 2007). The projected increase in jobs associated with the increased timber harvest and Forest Service expenditure related employment is largest for alternatives D. The increase in timber harvest can contribute to the maintenance and expansion of wood products manufacturing infrastructure.

**Table 78. Total jobs and income supported by national forest activities and programs by alternative for the Wallowa-Whitman socio-economic impact zone**

| Activity | Estimated Employment Contribution (direct, indirect, and induced) | | | | | |
|---|---|---|---|---|---|---|
| | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
| Recreation | 397 | 397 | 397 | 397 | 397 | 397 |
| Range | 258 | 242 | 102 | 267 | 258 | 258 |
| Timber | 201 | 245 | 104 | 845 | 506 | 320 |
| Expenditures | 466 | 466 | 429 | 545 | 484 | 454 |
| County payments | 72 | 72 | 72 | 72 | 72 | 72 |
| **Totals** | **1,395** | **1,422** | **1,104** | **2,126** | **1,718** | **1,502** |
| **Activity** | **Estimated Wage Income Contribution (direct, indirect, and induced)** | | | | | |
| | **Alt. A** | **Alt. B** | **Alt. C** | **Alt. D** | **Alt. E** | **Alt. F** |
| Recreation | $7,678 | $7,678 | $7,678 | $7,678 | $7,678 | $7,678 |
| Range | $3,435 | $3,241 | $1,304 | $3,556 | $3,435 | $3,435 |
| Timber | $11,112 | $13,526 | $5,723 | $46,722 | $28,000 | $17,716 |
| Expenditures | $22,766 | $22,766 | $21,166 | $26,181 | $23,558 | $22,245 |
| County payments | $2,389 | $2,389 | $2,389 | $2,389 | $2,389 | $2,389 |
| **Totals** | **$47,379** | **$49,600** | **$38,259** | **$86,526** | **$65,060** | **$53,463** |

## Civil Rights and Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations, directs federal agencies to integrate environmental justice considerations into federal programs and activities. Environmental justice means that, to the greatest extent practical and permitted by law, all populations are provided the opportunity to comment before decisions are rendered or are allowed to share in the benefits of, are not excluded from, and are not affected in a disproportionately high and adverse manner by government programs and activities affecting human health or the environment.

In order to identify and address environmental justice concerns, the executive order states that each agency shall analyze the environmental effects, including human health, economic, and social effects of Federal actions, including effects on minority populations, low-income populations, and American Indians as part of the NEPA process.

It is the policy of the Forest Service that the responsible Forest Service official (FSM 1704) review proposed actions for civil rights impacts and take either of the following actions in compliance with DR 4300-4 and 1010-1 (FSM 1730.1): prepare a civil rights impact analysis and statement of its findings for any proposed policy or organizational action which may have a major civil rights impact, or document the determination that a civil rights impact analysis and a statement of findings are not needed.

### *Effects and Findings*

In the socio-economic impact zones for the Blue Mountains national forests, the population is generally less diverse than that of Oregon. However, the Umatilla socio-economic impact zone has a larger proportion of Hispanic or Latino population and a larger proportion of American Indians and Alaska Natives than statewide (see table 30). The American Indian population is also proportionately larger than the state in the Malheur socio-economic impact zone. There are proportionately more people living in poverty in the three socio-economic impact zones than throughout the state (see table 31). There are two exceptions in the Malheur socio-economic impact zone: Hispanic or Latino and minorities (excluding Native Americans) have proportionately lower amounts of poverty than statewide.

The Forest Service has provided notice of comment opportunities and has considered all public input from people or groups regardless of age, race, income status, or other social/economic characteristics. There would be no adverse effects to human health and no alternative has been determined to disproportionately affect minority or low income populations.

Potentially affected American Indian tribes have been consulted. Avoidance of cultural resources, consideration of traditional values, and reasonable access through agreements, permits, and recognition of their sovereignty and legal rights are all part of the development and evaluation of the alternatives. As a result, American Indian populations would not be disproportionately impacted by any alternative.

A review of the alternatives shows the social and economic effects are generally small across the entire population. Using the alternative employment and income effects as an indicator of potential impacts to the minority, low income and the overall population, the Malheur zone with about 15 percent of the zone's employment and income contributed by Forest Service activities, would be most impacted. Alternative C would negatively affect the overall employment contribution by about 25 percent. This means about four percent of the current employment base would be affected. Alternative D would result in close to a 30 percent increase in the Forest Service contribution to the Malheur zone. This could represent a 5 percent increase in total employment opportunities in the zone.

The contribution to employment and income by the Forest Service in the Umatilla zone is less than one percent. The measureable impacts to the population for any of the alternatives are proportionately small. In the Wallowa-Whitman zone, the employment income contribution is about five percent. Alternative D has the greatest potential impact with the Forest Service contribution increasing by 50 percent.

No adverse civil rights or environmental justice impacts are anticipated at the national forest level for any under-represented population or to other populations or communities. While forestwide level impacts are not expected to be disproportionate, adverse impacts may be possible at the project planning level. Differences in forestwide effects and project-level effects are the result of uneven distributions of minorities and low-income populations geographically. Civil rights and environmental justice impacts will be examined at the local level with NEPA analysis for site-specific projects.

## Issue 3: Livestock Grazing and Grazing Land Vegetation

As with many actions that involve the removal of natural resources from public land; livestock grazing, or the removal of forage by domestic animals (primarily cattle and sheep), is a an increasingly debated and highly controversial issue. This issue is shaped by opinions and scientific papers ranging from complete elimination of livestock's use of public lands, to increases in the use of public land by livestock. In dealing with this issue, the Forest Service strives to sustain the health, diversity, and productivity of the land to meet the needs of present and future generations by using the best available science and an ecological approach to multiple use management.

In this section, the interdependency of social and economic factors and how they relate to national forest management designed to maintain or restore the composition and structure of vegetation will be addressed. These factors include the conditions of and desired condition of grazing land vegetation especially in riparian areas, the potential for disease transmission from domestic sheep to bighorn sheep, and the concern that further restrictions on grazing allotment management would adversely affect livestock operations and the livelihoods of those who graze the forest.

Livestock grazing and grazing land vegetation is discussed in several sections of this chapter including but not limited to: Economic and Social Well-Being, Aquatics, Terrestrial Wildlife, Watershed, and Plants.

Grazing land vegetation and livestock grazing will be discussed as separate topics. Cumulative effects will be discussed together at the end of this section. The economic contributions of livestock grazing and grazing land vegetation are discussed in the Economic and Social Well-Being section of this document.

## History of Grazing in the Blue Mountains

Although Marcus Whitman brought several head of cattle to the Walla Walla River valley in 1836, more substantial numbers of cattle and sheep were initially brought into northeastern Oregon and southeastern Washington during the 1840s via the Oregon Trail. Native American horse herds were already large and well established by then, having arrived in the Blue Mountains around 1730 after migrating northward from the Santa Fe, New Mexico area.

Livestock grazing on Forest Service land has been essential in meeting the needs of the areas inhabitants, beginning even before the Forest Service was formed in 1905. In the early 1900’s, when permits were first issued for livestock grazing, settlers living near Forest Service boundaries could obtain a free use permit to graze up to ten domestic animals on government land during the specified season. In addition, ranchers could graze larger numbers of animals on Forest Service lands, providing they purchased a permit, confined their animals to the allotted area, and salted them according to established guidelines.

The general picture of Forest Service livestock management, beginning in the first decade of the 1900s, is one of initially working to control livestock numbers (e.g., institution of permit systems, assignment of allotments, allocation of permitted livestock numbers, and seasons). This was followed by a period of working to fence national forest and allotment boundaries and to develop water sources to keep permitted livestock where they belonged and to curtail trespass livestock and to keep trespass livestock outside National Forest System lands. This in turn was followed in the mid-1900s by an emphasis on rangeland restoration (e.g., seeding and erosion control) and the beginning of development of cross fencing to increase livestock control and implement intensive grazing management systems.

Throughout this period from the very early 1900s through the mid- to late-1900s, there were very large reductions in permitted livestock. Forest Service records indicate a dramatic reduction in permitted numbers and seasons, as well as actual numbers and animal unit months (AUMs) during the first decade or so of Forest Service management. In some cases, numbers permitted were allowed to increase during both World War I and II with permitted use again declining following the war years. Since the World War II, reductions have been relatively steady and slow as management was adjusted on an allotment specific basis to bring stocking rates in line with both land and management capability. Current permitted numbers, seasons, and AUMs are estimated to be a small fraction of what occurred prior to Forest Service management. Irwin (1994) estimated that AUMs for the Wallowa-Whitman National Forest decreased from 700,000 in 1915 to about 200,000 in 1985. In 1905, just prior to the establishment of the Wenaha Forest Reserve, the northern half of the Umatilla supported somewhere in excess of 275,000 head of grown sheep plus their increase, 40,000 head of cattle, and 15,000 head of horses. By the late 1930s, however, permitted livestock numbers for the entire Umatilla National Forest had been reduced to 88,102 head of sheep and 8,528 head of cattle (Powell 2008). The Wallowa-Whitman closed numerous sheep allotments in the mid 1990's to reduce the potential for disease transmission between the domestic sheep and bighorn sheep.

During the latter 1900s, the emphasis shifted to more intense livestock management and to the application of the best available scientific information. Allotments were cross-fenced into a greater number of pastures and rotation systems were established to ensure rest or deferment (e.g., no grazing until after the key forage plants had passed the most critical periods of growth). Permitted livestock numbers continued to trend downward but at a relatively slow pace. Throughout this period, permitted seasons were reduced to conform to standard range readiness criteria. These criteria focused on ensuring that livestock did not enter National Forest System rangelands until soils were dry enough and plants had passed the most critical periods of growth to ensure that impacts from livestock were minimal. End of season criteria were also set and adjusted based on certain factors, such as minimizing conflicts with recreation, moving before snow accumulation, and ensuring that adequate forage resources remained for large wild ungulate winter range needs. In addition, with the development of allotment cross-fencing, management was able to more actively manage use periods so as to better provide for plant growth, regrowth, and reproduction. In general, these principles are still followed, although improved understanding of plant and soil needs has allowed for adaptive management principles to be followed with regard to seasons of use, as well as authorized numbers, age classes, and types of livestock.

Finally, during the past 20 to 30 years, an awareness of the importance of riparian areas and wetlands and aquatic resources, supported by an increased emphasis on Endangered Species Act listed fish species and habitats, has resulted in implementing intensive grazing management practices. These practices are primarily focused on restoring riparian and stream conditions and on minimizing or avoiding conflict between permitted livestock and the listed fish species and their habitats. During this time period, additional monitoring has occurred to assist in the application of adaptive management principles focused on sustaining permitted livestock use while improving aquatic habitats. With localized exceptions, riparian areas in the project area are in improved condition and are trending toward continued recovery (Archer 2009). Much of the recovery to date has occurred in terms of riparian vegetation with recovery in stream morphology tending to be slower and more localized. In part, this is due to the nature of the processes involved (e.g., vegetation can grow and reproduce relatively quickly given the opportunity while hydrologic process recovery takes more time). It is also due to the multiple impacts affecting stream hydrology (e.g., roads, livestock, Forest Service management, fire management, recreation, etc.). In most cases, the recovery noted to date has been accomplished in the presence of permitted livestock along with more intense management. Some areas of concern remain but, for the most part, these are relatively localized and can be dealt with through improved management. However, there may be situations where livestock exclusion is the most appropriate or logical treatment.

In addition to the management changes, decreased AUMs, and increased focus on restoring riparian health that has occurred over the last century, the National Forest System uses the administrative acts, bills, and plans listed in appendix F as the legal framework for managing livestock.

## Analysis Assumptions

Grazing by livestock or native herbivores can affect grazing land health, including removing plant material, trampling soils (compaction, displacement, and structural damage), and trailing (alteration of water flow patterns). With proper management these impacts are insignificant compared with the natural resilience of the grazing land ecosystem. However, excessive grazing can cause impacts that move a system beyond its short-term ability to maintain functionality. Excessive impacts for an extended period can cause the system to cross thresholds that permanently alter it beyond its ability to recover (Laycock 1994, Miller et al. 1994). It is assumed in this document that, in general utilization of 40 percent or less of the forage on the landscape would result in proper management (see discussion of utilization below).

Grazing land, especially riparian and wetland areas are subject to impacts from a wide variety of other uses and activities. The most critical of impacts come from roads (impacts to riparian/aquatic water relationships), large wild ungulates (impacts primarily to spring and fall rangelands), and fire (impacts from fire exclusion, wildfire/prescribed fire, and natural drought cycles).

All alternatives include management standards or guidelines that provide for the sustainability of the grazing lands of the planning area. Grazing land health and sustainability is defined by the degree to which the integrity of soils and the ecological processes of grazing land ecosystems are maintained in a healthy functional status over time in response to various disturbance processes. The determination of whether or not grazing lands are healthy depends on the levels of soil stability and watershed function, the integrity of nutrient cycles, plant species composition, and the level of disturbance resiliency relative to site potential.

State and Transition Models are tools that can demonstrate visually the changes to plant communities as a result of natural and/or human caused disturbances. State and Transition models utilize the same combination the ecological concepts used to support PNC (Potential Natural Community) and HRV (Historic Range of Variability), paired with additional relevant site data and knowledge of plant responses to management activities. These models are becoming more important resource in order to assist managers and help determine what the potential of a rangeland ecological site is in order to work towards a desired condition, identify the causal factors for improvement or degradation of an ecological site, or identify if the site has been too severely altered to be able to work towards PNC without active restoration. In a basic sense the ‘states’ in a State and Transition model is shows the range of plant communities possible given the physical rangeland site characteristics, and the ‘transition’ demonstrates the natural or human caused disturbances that can or have occurred, and what the resulting plant community could be post disturbance. Work by Stringham et al. in 2003 is a more technical reference to explain State and Transition models, and is within the list of sources cited.

The other important component to a State and Transition model is when the ecological site has been so severely disturbed that it has crossed a threshold, in which it will not improve without an active restoration strategy. In situations where ecological sites have crossed a threshold, restoration through modification of livestock management is not possible. These areas must be managed for modified goals and objectives recognizing a new potential condition and rate of recovery for the new transitioned state.

The desired conditions are defined by layers of management direction. A desired condition is identified where HRV objectives with the *Public LURs* definitions of satisfactory condition (i.e., fair range forage condition with an upward trend or better) are met by attaining a mid-seral ecological status with an upward trend or higher condition based on the PNC, and recognizes that some communities have been altered, changing the PNC. Where ecological sites in state A are managed to maintain their current state, and ecological sites in states B and C are managed to transition toward state A (Stringham et al. 2003, Swanson and Johnson 2008, and Bestelmeyer et al. 2009). In situations where ecological sites have crossed a threshold (state D), restoration through livestock management is not possible. These lands are considered to be in unsatisfactory condition, and may have continued livestock use along as the rate of recovery of these sites is within 70 percent of the natural rate of recovery (HCNRA CMP FEIS 2003 pp C-38). Because of the time and expense to restore the condition of sites that have crossed a threshold, there are not any plans to do active restoration in the near future.

The basic measures of grazing land health are tied to the state and transition models with phases A and B presumed to be capable of ensuring long-term sustainability and resiliency. Phase C is assumed to be of concern but is still likely to allow grazing land to operate within the range of natural variability. Phase D is assumed to have resulted from some impact that may have crossed a threshold. Although there is no direct measure of grazing land health parameters associated with these phases, impacts to grazing land vegetation are often directly related and correlated to impacts to the soil resource. Therefore, the use of the phases model is believed to be a good representation of soil stability, nutrient cycles, disturbance resilience, plant species composition and health, and watershed function.

In order to provide context, especially for the economic and well-being section of this document, the total animal unit months (AUMs) available for each alternative must be estimated. For a variety of reasons, AUMs can vary on an annual basis, as well as by forest. For this reason, the number of livestock permitted between 2007 and 2009 was averaged for each forest and then divided by the number of suitable acres within active allotments in 2010 to obtain an average AUM per suitable acre. This was then used to estimate the number of livestock AUMs for each alternative, including alternative A to allow unbiased comparison between alternatives.

## Design of the Alternatives

All alternatives are designed to maintain the health, sustainability, and resilience of grazing land as part of the broader landscape. How standards and guidelines would be applied and management direction for ensuring the separation of bighorn and domestic sheep make up the key differences between the alternatives. In addition, suitability for livestock grazing by alternative varies where there is more intensive management required for riparian management areas, botanical areas, Research Natural Areas, federally listed or species at risk plants, federally listed fish or critical habitat, occupied sage grouse habitat, grazing after wild fire, or wild and scenic river corridors.

For all alternatives, permitting of domestic livestock and stocking of allotments would remain a project-level decision based on guidance provided by the forest plans. This could potentially include stocking of vacant allotments.

All of the action alternatives vary in the percent utilization of woody and herbaceous vegetation within riparian management areas, but they have the same minimum residual stubble height (at the greenline) of 4-6 inches and the maximum bank alteration of 20 percent.

Alternative A would continue current forest plan direction as amended by PACFISH/INFISH requirements. Grazing permit authorizations have diminished since 1990 due to the Federal listing of fish species per the Endangered Species Act and the PACFISH and INFISH amendments to the 1990 forest plans. These changes resulted in stricter management direction for livestock grazing in riparian areas (table A-9, appendix A). Upland grazing has continued to be managed according to direction provided by Region 6 of the Forest Service (table A-8, appendix A) during the development of the current plans. Within the three national forests, 219,000 acres would be generally suitable for sheep grazing, and 3,020,000 acres would be generally suitable for cattle grazing. Alternative A does not include specific plan components to reduce the potential for or prevent disease transmission from domestic sheep to bighorn sheep on the Umatilla National Forest, although, the Forest has closed several allotments to minimize the effects to bighorn sheep from disease transmission from domestic sheep. The forest plan for the Malheur National Forest contains management direction not to stock livestock pastures within bighorn sheep ranges with domestic sheep. The Wallowa-Whitman forest plan states that management of bighorn sheep will be in accordance with a 1982 document “Wild Bighorn Sheep Conflicts with Domestic Livestock and other Wildlife Ungulates on the Wallowa-Whitman Forest -A Summary Status Report and Interim Program Direction” [Wildlife S&G #5, page 4-45]. Similar to the Umatilla, the Wallowa-Whitman has closed several sheep allotments.

**Table 79. Management direction for the maximum percent utilization of livestock grazing in uplands**

| National Forest | Management Level | Forested | | Grasslands | | Shrubland | |
|---|---|---|---|---|---|---|---|
| | | Satisfactory | Unsatisfactory | Satisfactory | Unsatisfactory | Satisfactory | Unsatisfactory |
| MAL* | Stewardship B | 40% | 0-30% | 50% | 0-30% | 40% | 0-25% |
| | Extensive C | 45% | 0-35% | 55% | 0-35% | 50% | 0-30% |
| UMA | Stewardship B | 40% | 0-30% | 50% | 0-30% | 40% | 0-25% |
| | Extensive C | 45% | 0-35% | 55% | 0-35% | 45% | 0-30% |
| | Intensive D | 50% | 0-40% | 60% | 0-40% | 50% | 0-35% |
| WAW | Stewardship B | 40% | 0-30% | 50% | 0-30% | 40% | 0-25% |
| | Extensive C | 45% | 0-35% | 55% | 0-35% | 45% | 0-30% |
| | Intensive D | 50% | 0-40% | 60% | 0-40% | 50% | 0-35% |
| OCH | Stewardship B | 40% | 0-30% | 50% | 0-30% | 40% | 0-25% |
| | Extensive C | 45% | 0-35% | 55% | 0-35% | 45% | 0-30% |
| | Intensive D | 50% | 0-40% | 55% | 0-40% | 50% | 0-35% |

* Does not mention level D.

For the Umatilla National Forest, utilization of transitory range (where timber harvest has occurred during the last 30 years) shall not exceed 60 percent for domestic livestock.

Alternative B utilizes the status of allotments as of 2010. The estimated numbers of permitted cattle are fewer than alternative A, and acres suitable for grazing would also be fewer. Permit authorizations for grazing sheep would be slightly reduced to lessen the risk of disease transmission from domestic sheep to bighorn sheep. This alternative identified areas as unsuitable for domestic sheep/goat grazing that were estimated to have a 95 percent probability of contact with wild sheep. It also anticipated the reestablishment of the Canyon Mountain wild sheep herd. Alternative B and the other action alternatives all include measures (standards and guidelines) to reduce the potential for or prevent disease transmission from domestic sheep to bighorn sheep. Management actions would be in cooperation with state wildlife agencies.

**Table 80. Management direction for maximum percent utilization of livestock grazing in riparian areas**

| National Forest | Management Level | Grass and Grass-like | | Shrubs | |
|---|---|---|---|---|---|
| | | Satisfactory | Unsatisfactory | Satisfactory | Unsatisfactory |
| MAL* | Stewardship B | 40% | 0-30% | 30% | 0-25% |
| | Extensive C | 45% | 0-35% | 40% | 0-30% |
| UMA | Stewardship B | 40% | 0-30% | 30% | 0-25% |
| | Extensive C | 45% | 0-35% | 40% | 0-30% |
| | Intensive D | 50% | 0-40% | 50% | 0-35% |
| WAW | Stewardship B | 40% | 0-30% | 30% | 0-25% |
| | Extensive C | 45% | 0-35% | 40% | 0-30% |
| | Intensive D | 50% | 0-40% | 50% | 0-35% |
| OCH | Stewardship B | 40% | 0-30% | 30% | 0-25% |
| | Extensive C | 45% | 0-35% | 40% | 0-30% |
| | Intensive D | 50% | 0-40% | 50% | 0-35% |

* Does not mention level D.

In general, livestock management in riparian areas under all action alternatives incorporates the Aquatic and Riparian Conservation Strategy developed by Region 6 of the Forest Service. Alternative B incorporates a utilization guideline within riparian management areas of 40 percent on both herbaceous and woody vegetation. The guideline for upland utilization of herbaceous vegetation is 50 percent or less in areas of season long use and of low departure from the desired condition. Where a management system is in place (e.g., deferred rotation, rest rotation) utilization may reach 55 percent in areas of low departure from the desired condition. Where there is moderate or greater departure from desired condition utilization is expected to be 30 percent or less under season long and 35 percent or less with a management system in place. Upland shrub utilization is not expected to exceed 45 percent.

In alternative C the area that would be generally suitable for cattle grazing would be reduced to approximately 786,000 acres, the smallest projection among alternatives. This decrease would result from the classification of riparian areas and subwatersheds with habitat for listed fish species as generally unsuitable for cattle grazing. Riparian management areas in alternative C would have a width of 300 feet on either side of all streams, regardless of stream class. The area that would be generally suitable for sheep grazing would be reduced to approximately 98,000 acres, also the lowest projection among alternatives. This decrease would result from the classification of subwatersheds within the maximum foray distance for bighorn sheep rams as generally unsuitable for sheep grazing. Any area that was not previously determined to be unsuitable as a result of site factors (slope, vegetation, canopy cover), or was outside of a listed fish subwatershed, or not within 300 feet of a stream was identified as suitable.

In general, livestock management under alternative C incorporates a utilization guideline within riparian management areas of 10 percent on herbaceous vegetation and 25 percent on woody vegetation. Upland utilization of herbaceous vegetation is a standard of 30 percent under all management systems regardless of departure from the desired condition. Upland shrub utilization is a standard not to exceed 25 percent.

In alternative D, grazing permit authorizations for cattle would be greater than the current condition. The assumption is that portions or all of some vacant allotments would be stocked and as a result, suitable acres in active allotments would increase. Permit authorizations for grazing sheep would be slightly reduced to reduce the risk of disease transmission from domestic sheep to bighorn sheep. This alternative identified areas unsuitable for domestic sheep/goat grazing that would provide a moderate level of confidence (greater than 50 percent) of no contact with wild sheep by incorporating the 95 percent confidence area with existing EIS or preferred alternative DEIS decisions. It does not consider the reestablishment of the Canyon Mountain wild sheep herd.

Management of livestock in riparian areas is the same as proposed in alternative B, except that the riparian management areas are between 50 and 100 feet in width. Upland grazing would have a desired utilization of herbaceous vegetation of 40 percent or less in areas of season long use and of low departure from desired condition. Where a management system is in place (e.g., deferred rotation, rest rotation) utilization may reach 50 percent in areas of low departure. Where there is moderate or greater departure from desired condition utilization is expected to be 40 percent or less under season long and 45 percent or less with a management system in place. Alternative D has no utilization guideline for upland shrubs. Most other grazing management under alternative D would use desired conditions to address livestock grazing and rangeland vegetation rather than the standards and guidelines proposed for all other alternatives.

Alternatives E and F would be the same as alternative A regarding permitted numbers for cattle and acres suitable for grazing. Permit authorizations for grazing sheep to reduce the risk of disease transmission from domestic sheep to bighorn sheep for both alternatives would be the same as in alternative D.

The desired upland utilization for both E and F for herbaceous vegetation is 35 percent or less in areas of season long use and of low departure from desired condition. Where a management system is in place (e.g., deferred rotation, rest rotation) utilization may reach 40 percent in areas of low departure. Where there is moderate or greater departure from desired condition utilization is expected to be 30 percent or less under season long and 35 percent or less with a management system in place. Upland shrub utilization is not expected to exceed 40 percent.

Although both E and F follow the guidelines of the Aquatic and Riparian Conservation Strategy alternative E incorporates a utilization guideline within riparian management areas of 25 percent on both herbaceous and woody vegetation within bull trout watersheds and 40 percent in all other watersheds. Alternative F, on the other hand, incorporates an additional utilization guideline for watersheds containing anadromous fish of 35 percent for the Umatilla and Wallowa-Whitman National Forests.

Additionally, both alternatives include an objective designed to improve a portion of rangeland in phase C or D to phase A or B for all three National Forests. These two alternatives also incorporate the Oregon Department of Fish and Wildlife greater sage-grouse conservation strategy. There are guidelines surrounding fence building with in greater sage grouse habitat, livestock turnout and utilization guidelines.

**Table 81. Maximum percent utilization of key grass and forbs species within upland sites***

| Management System | Alt. B Departure from Desired Condition (guideline) | | Alt. C Departure from Desired Condition (standard) | | Alt. D Departure from Desired Condition (guideline) | | Alt. E and F Departure from Desired Condition (guideline) | |
|---|---|---|---|---|---|---|---|---|
| | Low | Moderate or Greater | Low | Moderate or Greater | Low | Moderate or Greater | Low | Moderate or Greater |
| Season long | 50 | 30 | 30 | 30 | 45 | 40 | 35 | 30 |
| Management systems that incorporate deferment, rest, rotation | 55 | 35 | 30 | 30 | 50 | 45 | 40 | 35 |

* Utilization should be based on a point in time measurement. It includes all use by permitted livestock, wildlife, insects, wildfire, or recreational use. Utilization will be based on height-weight curves and/or ocular estimates or other approved measures. Utilization is based on key species.

Low-moderate departure: phase A or B.

Moderate or greater departure: phase C or D.

**Table 82. Allowable shrub utilization**

| Alternative B | Alternative C | Alternative D | Alternatives E & F |
|---|---|---|---|
| Guideline<br>Upland shrub utilization should not exceed 45 percent as determined by any science-based method. | Standard<br>Upland shrub utilization shall not exceed 25 percent as determined by any science-based method. | This alternative has no corresponding management direction. | Guideline<br>Upland shrub utilization should not exceed 40 percent as determined by any science-based method. |

**Table 83. Maximum utilization within riparian management areas***

| Measure | Alt. B | Alt. C** | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|
| Maximum percent utilization of woody vegetation (percent of mean annual vegetative production) | 40% | 25% | 40% | 25% within bull trout spawning and rearing reaches<br>40% for all other watercourses including anadromous fish reaches | 30% in bull trout spawning and rearing habitat (all three national forests)<br>35% in anadromous fish reaches (UMA and WAW)<br>40% outside bull trout spawning and rearing habitat (MAL)<br>40% outside anadromous fish reaches (UMA and WAW) |
| Maximum percent utilization of herbaceous vegetation(percent of mean annual vegetative production) | 40% | 10% | 40% | 25% within bull trout spawning and rearing reaches<br>40% for all other watercourses including anadromous fish reaches | 30% in bull trout spawning and rearing habitat (all three national forests)<br>35% in anadromous fish reaches (UMA and WAW)<br>40% outside bull trout spawning and rearing habitat (MAL)<br>40% outside anadromous fish reaches (UMA and WAW) |

* In addition, the minimum residual stubble height (applies at the greenline) for all alternatives is 4 to 6 inches. ** For alternative C, this is a standard for maximum utilization within riparian management areas.

## Affected Environment – Grazing Land Vegetation

Grazing lands have been affected by a wide variety of natural and human influences. The human influences have often been concurrent throughout the Forest Service and a result of an increase in multiple use of the land, as well as the application of the emerging and developing science of land management.

### Rangeland Vegetation

Indicators for rangeland vegetation within the three national forests include:

- Rangeland and riparian vegetative composition and condition
- Grazing land phases and progress towards achievement of desired conditions
- Fire exclusion and extinguishment

#### *Rangeland and Riparian Vegetative Composition and Condition*

Grazing lands provide forage for wildlife, permitted livestock, and wild horses, as well as habitat for a wide variety of animal and plant species, including rare or unique plant species and communities. Grazing lands and associated plant communities also provide important watershed values, including soil protection and maintenance, high quality water storage and slow release, and biodiversity. Other intrinsic values associated with rangelands include maintenance of open space, visual beauty, and areas for recreational activities.

Rangelands are a key component of the plan area and account for approximately 765,000 acres, or about 16 percent, of National Forest System (NFS) lands of the 4.9 million acres within the three national forests, excluding the HCNRA. Including the additional grazable forest lands, the total grazing land within the plan area is approximately 3,395,000 acres, or approximately 69 percent of the national forests. The distribution of these lands is displayed in table 84.

**Table 84. Grazing land for each national forest**

| National Forest | Rangeland (acres) | Grazable Forestland (acres) | NFS Lands Classified as Grazing Land (percent)* |
|---|---|---|---|
| MAL | 230,000 | 1,270,000 | 88% |
| UMA | 240,000 | 570,000 | 58% |
| WAW | 295,000 | 790,000 | 60% |

* total of rangeland and grazable forestland

Measures more restrictive than those of the 1990 forest plans were implemented in 1995 with the intent of protecting, conserving, and managing riparian habitats for protected resident and anadromous fish species. Monitoring of the effectiveness of these measures began in 2001 as required by the PACFISH/INFISH biological opinion (PIBO). To date, repeat PIBO sampling has been completed on more than 200 monitoring reaches in the Blue Mountains (Archer et al. 2009). In the case of riparian areas and wetlands, this monitoring information, combined with long-term camera point monitoring and professional observation, indicates that there has been recovery in many areas for many of the parameters most closely associated with livestock grazing effects (managed sites). However, this has not occurred to the extent that all sites most associated with livestock grazing effects, as well as road or recreation effects, have recovered to the point that they fully meet desired conditions. At the scale of the Blue Mountains, favorable trends have been observed in 18 of 24 aquatic and riparian habitat variables measured at managed sites and observed differences in seven of the variables are statistically significant (PIBO data). In addition, large differences remain in several variables between managed and reference sites. Vegetative variables are improving at a faster rate than physical habitat (channel) variables. While PIBO monitoring points within areas managed for permitted livestock tend to be at a lower current condition relative to specific parameters than are reference sites (not grazed by permitted livestock), the difference may or may not be significant, depending on the specific parameter. For example, while there are differences in bank angle (favoring the reference sites), there is no apparent difference in bank stability between reference and managed areas, although there were apparent improvements in the reference sites based on repeat sampling. Further, repeat monitoring findings show little difference in effective ground cover between reference and managed sites, although green-line cover was greater at the reference sites than at the managed sites. This trend was also borne out by sampling of cross-section vegetation. One key finding was that at the managed sites, nonnative plant cover was consistently greater than on the reference sites.

Overall, PIBO monitoring tends to show a more stable riparian condition at the reference sites. While certain parameters recorded lower values at the managed sites relative to the reference sites, the raw data shows that, in general, the sites open to livestock grazing were recovering in the presence of managed livestock grazing.

These findings are supported by information, such as long-term camera points, dating, in some cases, to the late 1920s (Reid et al. 1991). These older photos, with periodic retakes, initially show extremely degraded riparian/aquatic systems with a virtual lack of woody or herbaceous vegetation, raw and down cut stream banks, and a significantly lowered water table. Following the camera points through time shows a dramatic increases in herbaceous vegetation (often beginning with Kentucky bluegrass followed by sedges and rushes) followed by increases in riparian hardwoods where adapted to the soils and the site. This is all accompanied by raising of the streambed, stabilization of the stream banks, and a significant raising of the water table. In some areas, this has occurred at a much faster rate than in others. And, in general, certain parameters respond more quickly than others. For example, effective ground cover tends to respond relatively quickly to improved management while recovery of shrubby vegetation is slower, and recovery of stream bank stability, bank angle, and general stream morphology occurs only within an extended timeframe. There are relatively localized areas where grazing continues to impact recovery (primarily by livestock but includes large wild ungulates in some areas, and wild horses in the Murderers Creek Wild Horse Territory), but it can also include the effects of roads and recreation (e.g., riparian dispersed camping and all-terrain vehicles).

With specific areas of concern remaining, many riparian areas and wetlands have improved relative to reference conditions (and relative to the early 1900s). It is believed that recovery is continuing at a relatively slow but steady rate. In some instances, this recovery may be accomplished through improved management of the impacting activities while in other cases exclusion of specific uses or activities or active restoration activities may be needed. Efforts have been ongoing to reduce the amount of time livestock have access to streams and the potential for trampling causing streambank alteration or stepping on redds. In some cases, the most effective method of protection which set stream habitat improvement on an accelerated trajectory was construction of livestock exclusion fences in critical areas on all three Forests.

### *Grazing Land Phases*

The occurrence and persistence of a specific plant community on a site is dependent on site specific factors ranging from disturbance factors such as wildfire, drought, livestock grazing, and browsing to more natural factors such as soil structure, soil moisture, shade, plant dominance or life cycle, competition from other plants and topography. Grazing lands are dynamic systems where, at any point, the interaction of physical and biological factors shapes the plant community and the occurrence of specific species. In response to disturbance, the vegetation of a given site may change in composition, dominant species, and vegetation structure. In resilient ecosystems, these changes are readily reversible by successional processes. However, large or ongoing disturbances may modify ecosystem processes and feedbacks beyond the limit of ecological resilience and result in the transition to an alternate state with limited potential for recovery (Westoby et al. 1989, Stringham et al. 2003, Briske et al. 2008). These are the primary assumptions of state and transition models, which describe known and anticipated pathways of vegetation dynamics in relationship to disturbance factors (Stringham et al. 2003, Briske et al. 2008).

State and transition models are useful tools to evaluate the condition of rangelands. A number of state and transition models for bunchgrass plant communities have been developed for the Blue Mountains (Johnson and Swanson 2005). Others have been derived from reference conditions of ecological site descriptions. These models are based on local vegetation data and expert opinions. Transitions between states are generally described by biotic thresholds based on vegetation composition.

Johnson and Swanson (2005) classify vegetation along a gradient of increasing departure from pristine, native vegetation (reference conditions). Phases A, and B are used to describe the distinctive plant communities in a state close to reference, which represents the historic range of vegetation dynamics of a site. Phase A is the most resilient plant community within that state and depicts reference conditions. Phase B shows moderate departure from reference conditions. Phase C is strongly departed from reference conditions. This is the at-risk phase, which is the least resilient and most vulnerable to transition to an alternate state.

Sites with vegetation conditions completely departed from the reference condition are classified as phase D. This phase represents various alternate states possible for a site. Examples for phase D include potential green fescue meadows now dominated by forbs and annuals, riparian meadows seeded with nonnative species like orchard grass and meadow foxtail, rangelands invaded by nonnative species like star thistle and ventenata, and conifer encroachment of grass and shrublands that are now void of bunchgrasses. Transitions to less desirable or more desirable phases can be caused by grazing, alteration of water tables through mining or irrigation, cultivation, fire suppression, and other large disturbances. It is important to note that sites in phase D may still fulfill many ecosystem functions, such as forage production and erosion control, and with additional disturbance, may transition to a different, either less or more, desirable state.

For forest plan analysis, current vegetation survey (CVS) plots were assigned to phases and states using vegetation attributes and surface cover. Soil erosion, compaction, or other alterations were not directly measured. Plant composition thresholds can be inadequate indicators of ecosystem resilience and future ecosystem behavior (Bestelmeyer 2006). Transitions across such biotic thresholds may be reversible given enough time and changes in management activities. Transitions across abiotic thresholds (such as loss of topsoil) are typically nonreversible without extensive restoration activities. Due to uncertainty regarding thresholds and sparse data for state and transition model validation, rangeland was classified into two categories: phases A and B include sites with little to moderate departure from reference, and phases C and D include sites that are strongly to completely departed from reference conditions and are either at risk to transition or have transitioned to an alternate state. Recovery to a previous state would require active restoration. Table 85 displays the percent of plots by national forest and phase type.

**Table 85. Summary (acres) of current vegetation survey plot phases for the existing condition (alternative A) for each national forest**

| Phases | MAL | UMA | WAW |
|---|---|---|---|
| A or B grazable forestland | 1,028,700 (81%) | 535,800 (94%) | 718,900 (91%) |
| C or D grazable forestland | 241,000 (19%) | 34,200 (6%) | 71,100 (9%) |
| **Total grazable forestland** | **1,270,000** | **570,000** | **790,000** |
| A or B rangeland | 59,800 (28%) | 98,400 (43%) | 118,000 (42%) |
| C or D rangeland | 170,200 (72%) | 141,600 (57%) | 177,000 (58%) |
| **Total rangeland** | **230,000** | **240,000** | **295,000** |

Desired conditions for National Forest System lands are best represented by phases A and B (little to moderate departure from reference conditions). However, a variety of past activities, such as livestock grazing, mining, and logging, have significantly altered rangelands and forestlands. Many of these activities predate the establishment of these national forests and have lasting effects on the structure and composition of vegetation cover.

In the Blue Mountains, grazable forestland sites represent the majority of the forage production. Within the Umatilla and Wallowa-Whitman National Forests, distribution among grazable forestland phase groupings are similar, with 91 to 94 percent in phases A and B (see table GR4). Within the Malheur National Forest, 81 percent of the grazable forestland is in phases A and B. Much of the phases C and D grazable forestlands within the Malheur National Forest is in the hot, dry upland forest type (ponderosa pine and fescue/mahogany/bitterbrush) and has probably been influenced by a variety of impacts, including wildfire followed by grazing, leading to the elimination of species, such as fescue or mountain mahogany.

True rangelands make up a relatively small component of the Blue Mountains national forests. The general condition of rangelands appears more departed from reference conditions than forestlands. Within the Umatilla and Wallowa-Whitman National Forests, phases A and B rangelands account for 42 or 43 percent of rangeland (see table GR4). For the Malheur National Forest, about 30 percent of rangeland is categorized in phases A and B. As with the grazable forestlands, most of the phases C and D rangelands may be the result of activities that pre-date the establishment of the Blue Mountains national forests. Whether or not these sites have indeed crossed a threshold and transitioned to an alternate state has to be analyzed on a case-by-case basis.

Forage conditions on grazable rangelands and forestlands have been evaluated during the last 50 years using condition and trend monitoring (i.e., the Parker Three-step method). Data from monitoring transects can serve as indicators of general rangeland conditions in the planning area. During the 1950s, average forage conditions were very poor; with average Parker scores of 15 out of a possible 100 (more information is available from the project record). These forage condition ratings have been steadily improving to an average of 56 in the 1990s. From 2000 to 2004, scores have decreased to an average of 47. In the 1950s, a large majority of plots had poor to very poor forage conditions (98 percent of plots scoring less than 40). Conditions have improved significantly, and only 39 percent of sites were in poor to very poor condition from 2000 to 2004. The rate of improvement has slowed so that the trend for the last 20 years appears static. However, very few plots exhibit an obvious declining trend.

Johnson (2003) and Reid et al. (1991) published findings from 50 years of photographic and vegetation sampling within subalpine grassland ecosystems in the Blue Mountains. The study followed the ecological recovery of sites that had been degraded by early 20th century unregulated grazing. They found that in general there had been substantial improvement in ecological status with increases in native grass species and ground cover that should prevent accelerated soil erosion. While substantial improvement has occurred, they still found room for more improvement.

Skovlin and Thomas (1995) used repeat photography to document long-term changes that had occurred on a variety of Blue Mountains vegetation types between the original series of photos taken prior to 1925 and the repeat photos taken in 1992. They found shifts from grassland to shrub steppe-juniper woodland. Canyon lands were in fair condition and appeared stable. The valley grasslands had improved in general and appeared stable. Surrounding foothills were found to be in poor to good condition with an upward trend in forage values and watershed stability. Mountain grasslands showed increases in conifer encroachment but were in fair condition and stable. Mountain meadows in general showed improvements in species composition, but there were some that had not improved in 75 years. Subalpine grasslands showed increases in conifer encroachment. In another repeat photography publication, Skovlin et al. (2001) also found increases in conifer encroachment onto grasslands.

In general, with proper management as prescribed through the standards and guidelines of all alternatives, it is possible to ensure that across the landscape of an allotment, most sites will be in phases A or B with some in phase C. In some cases, there will be residual phase D sites that remain from historic impacts but it is highly unlikely that additional phase D sites will be created relative to and under proper livestock management. Overall, all alternatives are expected to result in a mosaic of phases A or B and phase C sites scattered across the allotment landscape.

The large majority of these sites would be operating within the upper levels of their state and transition models such that they retain their long-term sustainability, are capable of responding to disturbance (to include disturbance by the permitted livestock), and to cycle through various transitions with the potential to ultimately return to their potential natural community. Given grazing patterns that are common to livestock, it is possible that that certain sites e.g., those preferred by the permitted livestock, could remain at the lower levels of the state and transition model and would not return to their potential plant community in the presence of livestock. However, there are innumerable factors that affect the distribution, stocking rates, grazing systems, season of use, and grazing intensity for each specific site; therefore it we can only assume that phases at specific sites may remain unchanged in a less than potential community. These factors are constantly variable and dependent on each individual manager’s method of livestock management which all have a consistent goal of meeting the standards and guidelines within this plan and the term and conditions their grazing permit. It is assumed that if permitted livestock have the effect of maintaining certain plant communities in specific locales in a lower status, across the landscape the mosaic of plant communities should be within their natural roles.

There are phase D sites within some allotments that have occurred as a result of many different types of impacts. For example, on some sites, conifer or shrub encroachment or canopy cover may be resulting in alteration of the rangeland plant community due to the lack of appropriate disturbance on overstory vegetation. In many instances, this would be due to a lack of periodic fire. Active restoration in the form of prescribed fire or forested revegetation management could result in the movement of these specific sites back into their near natural cycle, which could then allow them to return to their potential natural plant community. However, other sites have experienced severe enough impacts that they would be expected to remain in a phase D status for the foreseeable future. Phase D sites may have been impacted by many activities including; historic heavy and improper livestock grazing, road construction, recreation, logging, or mining impacts such that the topsoil is essentially absent and the site is no longer capable of restoration without a very significant effort.

The ability of a grazing land ecosystem to adjust to change depends upon the system's capacity to positively respond to disturbance events (or at least to respond in a minimally negative manner with the ability to recover in a reasonable timeframe). Response indicators include moving native vegetative cover and species composition toward potential natural communities; age class distribution that indicates adequate reproduction is occurring; and other plant community attributes that indicate the maintenance or improvement of soil stability, nutrient storage, and cycling.

### *Fire Exclusion and Extinguishment*

Throughout the Forest Service and the planning area, the exclusion of fire or rapid extinguishment of fire has been a common practice. This action has many unintentional effects to grazing land vegetation such as:

- It increases coniferous tree cover, which decreases forage production.
- It increases the height, cover, and density of sagebrush, primarily for mountain big sagebrush, which decreases native herbaceous cover. (Quigley et al. 1997) Where sagebrush density and size has progressed to a major extent, it has made it more difficult to reintroduce fire into the disturbance process.
- It increases the population, abundance, and range of Western Juniper (*Juniperus occidentalis*), a species known for its ability to capture precipitation while creating monocultures of trees with very little forage production at the ground level.

The impacts of grazing management before and after a fire have a dramatic effect on the response of vegetation to the fire and to what can be expected in the long term. The need for increased intensity of grazing management on burned areas can be understood by realizing the potential change in the plant community and associated animal response that can result from a burn (Clark and Miller 2001).

The response of individual plant species to fire varies significantly between and within species. Moreover, this response is influenced by a variety of fire parameters, including intensity, severity (e.g., amount of organic matter consumed), residence time, soil heating, season of burn, and time since last fire. These parameters can vary significantly among fires and within a fire. These variations can and will cause differences in the response of individual species and the community as a whole. In addition, numerous physical and climatic factors (e.g., fuel condition, weather, slope, and aspect), as well as biological factors (plant morphology and physiology) will influence post-fire effects on plant communities. This includes direct effects, such as the ability of individual species to recover from the effects of fire.

Expected recovery potential is a function of fire severity. Johnson (1998) reported that in lightly burned areas (low severity fires) the expected recovery is fairly quick and a natural recovery of one to two years would be expected. Moderately burned areas (medium severity fires) have a modest recovery rate of two to five years. Heavily burned (high severity fires) have a slow natural recovery and may require five or more years to recover.

## Affected Environment – Livestock Grazing

Indicators for livestock grazing within the three national forests include:

- Active allotments include acres and percent of National Forest System land in active grazing allotments and acres in active allotments suitable and capable for grazing
- Forage suitability and utilization includes AUMs for cattle and sheep
- Grazing after wildfire

### Active Allotments

Table 86 displays the total acres within each national forest in active cattle and sheep allotments, the acres suitable for grazing in those allotments, the percentage of those allotments suitable for grazing, and the percentage by national forest in active allotments. Suitability and capability for grazing within allotments is determined by factors that include canopy cover, steepness of slopes, plant production level, and soil condition (land type associations). Active allotments make up about 70 percent of the total land base within the plan area. This varies from 55 percent within the Wallowa-Whitman National Forest to 92 percent within the Malheur National Forest. Suitable acres in active allotments as a proportion of the plan area range from 28 percent within the Wallowa-Whitman National Forest to 81 percent within the Malheur National Forest.

**Table 86. Active allotments and allotments suitable for grazing for each national forest (existing condition 2013)**

| Measure | MAL | UMA | WAW |
|---|---|---|---|
| Active livestock grazing allotments (all land types) | 1,551,000 acres | 826,000 acres | 978,000 acres |
| Percent of national forest in active allotments | 91% | 59% | 54% |
| Suitable acres in active cattle and sheep grazing allotments (currently active only) | 1,299,000 acres | 344,000 acres | 433,000 acres |
| Percent of active allotment suitable for livestock grazing | 81% | 42% | 44% |
| Percent of national forest suitable for grazing (percent suitable within active allotments relative to all NFS lands) | 74% | 25% | 24% |

Table 87 displays the existing permitted AUMs by national forest. This number reflects how many head of livestock are permitted on the combined allotments.

**Table 87. Cattle and sheep animal unit months (AUMs) for each national forest**

| National Forest | Cattle and Sheep Permitted AUMs (2013) |
|---|---|
| MAL | 144,100 |
| UMA | 48,600 |
| WAW | 95,423 |

## Forage Suitability

In forest planning, the suitability and potential capability of National Forest System lands for producing forage for grazing animals and for providing habitat for management indicator species shall be determined as part of the 1982 Planning Rule, Section 219.20. Lands suitable for grazing and browsing shall be identified and their condition and trend shall be determined. The supply of forage for livestock grazing as well as wildlife species is required to be estimated. An evaluation was conducted in 2010 regarding forage availability and use, in part to determine if there is competition between wild and permitted forage users such that wild ungulate viability is being detrimentally impacted.

In general, the assessment (Countryman 2010) shows that at the landscape scale, forage availability is not a concern. In fact, forage resources are more than adequate to provide for existing and projected future needs of permitted livestock and large wild ungulates while ensuring landscape scale sustainability of rangeland ecosystems.

The 2010 assessment calculated pounds per acre of forage for each plant association group. The basic data for this was derived from the plant association guides completed for the Blue Mountains (Johnson 1987 and 1992). These estimates are at the national forest scale and are influenced by a number of variables, including variation in production on individual sites versus the broader averages, and variations in yearly climate that increase or decrease production. The permitted AUMs are generally 10 to 20 percent higher than the levels that are actually grazed in the allotment (yearly authorized number) each year. The utilization estimates displayed in table 88 represent the level that could be grazed on allotments each year.

**Table 88. Total forage production (in millions of pounds) and percent utilization by permitted livestock (current use levels) for each national forest**

| National Forest | Utilization per Year (cattle and sheep) | Production per Year on All NFS Lands | Production on Suitable Acres in Active Allotments | Percent Utilization on Suitable Acres in Active Allotments Used by Cattle and Sheep |
|---|---|---|---|---|
| MAL | 103 | 614 | 558 | 18% |
| UMA | 37 | 329 | 169 | 22% |
| WAW | 72 | 389 | 216 | 33% |

In addition to the percent utilization by sheep and cattle displayed in table 88, elk and deer are estimated to consume an additional 1.8 to 4.8 percent. At the scale of each national forest, the available information indicates a large excess of forage production that is capable of meeting the current and projected needs for permitted livestock, as well as for large wild ungulate populations in addition to providing for the basic needs of plants, soils, and other rangeland resources. There may be site specific conflicts, although they are believed to be generally small in scope and extent.

There are a number of factors involved in this assessment. First, a portion of National Forest System lands are not within allotments (either active or vacant). All of the forage produced on these lands is therefore available for basic plant, soil, and wildlife needs, as well as other resource needs.

Second, within any given allotment, not all of the acreage is actually capable and suitable for livestock. Unsuitable areas have high canopy cover (greater than 60 percent), steep slopes (greater than 45 percent for cattle and greater than 60 percent for sheep), or limited forage production potential (based on soil type). These unsuitable areas receive only incidental, if any, livestock grazing. The forage resources on this unsuitable portion are fully available for wildlife and other rangeland related resource needs.

Third, within the areas that are suitable for grazing, current allowable use criteria (utilization standards) are applied to the grazing resource. This means that in most cases 50 percent or less of the forage produced on these acres is available for grazing. The remaining forage production is fully available for other resource and basic plant/soil needs.

Fourth, within any given land area, livestock tend to be very selective grazers. GPS mapping of use by cattle on rangeland shows that they tend to concentrate in or near riparian areas or on lower, more gentle slopes with actual utilization tapering off as distance from water increases and as slope increases (Bailey 2001). Sheep are more able to utilize steeper slopes, but even with permitted sheep grazing, there are use preference patterns across the landscape. By operating under science-based allowable use criteria, the average, actual use of the rangelands tends to be much less than the allowable use levels across the suitable range.

Finally, livestock are only permitted for a limited season of use. In general, this period occurs from about mid-May or early June to late September or mid-October. This means that for the majority of the year there is no competition for space or forage between permitted livestock and wildlife.

In summary, not all of the grazing lands within the planning area are both suitable for livestock grazing and are within an allotment. On suitable grazing lands within allotments, annual allowable use criteria restrict the total forage harvested. As a result of livestock grazing preferences and habits, only a portion of the allowable forage is harvested by livestock, with the remaining forage available for wildlife and basic soil/plant and other resource needs.

While much of the impact from introduced plants has come from noxious weeds that are commonly treated to the extent possible, there are infestations that have limited management options and therefore are not commonly treated. Annual invasive grasses, including cheatgrass (*Bromus tectorum*), are aggressive or harmful nonindigenous plant species. Cheatgrass has invaded the planning area and can be found in many grassland and shrubland habitats. It normally has minimal influence except where significant disturbances, such as fire and excessive or improper grazing or vegetation management practices, have allowed the species to spread and become common (Quigley et al. 1997).

With changes in the historic disturbance regimes, the long-term resilience of some grazing land plant communities has changed. For example: many dry meadows within the planning area have been occupied by Kentucky bluegrass (*Poa pratensis*) (Quigley et al. 1997). This is believed to have occurred as a result of multiple and severe historic impacts to the water-soil relationships of riparian areas. Heavy livestock grazing from the late 1800s through perhaps the mid-1900s impacted palatable (and grazing sensitive) native plants and favored the spread of bluegrass. In addition, bluegrass and several other nonnative species were often planted in over-grazed areas as they are more tolerant of grazing than native bunchgrasses and are better competitors against cheatgrass.

Construction of roads and railroads to support logging and recreational activities very often dramatically altered hydrologic regimes and resulted in drier riparian and wetland soil conditions. This impacted the native herbaceous species composition to favor more drought tolerant (often upland) species, including favoring the more drought and impact tolerant bluegrass. In summary, disturbances from wild ungulate populations, wild horses, increased recreational activities, roads, altered fire regimes, and forested vegetation management practices have altered hydrologic processes and caused some riparian areas to transition from moist or wet meadows to dry meadow or even upland conditions. While the vegetation composition of these sites is strongly to completely departed from historic reference conditions, sites may remain productive for forage.

Similar processes can be observed across upland portions within the planning area, such as where increased densities and canopy cover of conifers has negatively impacted understory herbaceous and shrubby plant composition and cover, or where a lack of fire disturbance has resulted in a loss of aspen plant communities (and its herbaceous understory) due to a replacement by conifers. In other areas, upland woody species and communities, such as bitterbrush (*Purshia tridentata*) and mountain mahogany (*Cercocarpus* spp.), have been dramatically impacted as historic alteration in natural fire frequency and intensity resulted in invasion of the sites by conifers to the extent that when fire occurs, the intensity is much more severe, and the upland shrub species are unable to successfully reestablish (Quigley et al. 1997). When regeneration does occur, excessive and/or improperly timed browsing by ungulates can suppress regeneration and growth.

Road development and the associated increase in recreational driving have increased during the past few decades. The increase in off-road vehicle use has resulted in a corresponding increase in the spread of invasive plants, disturbance of soils (erosion, loss of soil vegetation cover), and disruption of livestock or other rangeland management activities (e.g., gates left open, water sources damaged, grazing systems disrupted).

### Avoiding Domestic Sheep Potential for Disease Transmission to Bighorn Sheep

Grazing by domestic sheep can increase the risk of disease transmission to bighorn sheep (George et al. 2008). Bighorn sheep are highly susceptible to some strains of Pasteurella that are carried by domestic sheep (Foreyt et al. 1994). The disease, which does not affect domestic sheep, is usually fatal to bighorn sheep. Transmission of the disease can occur when bighorn sheep and domestic sheep occupy the same area and come in physical contact with each other (Coggins 2002, Clifford et al. 2009).

As a result of die-offs and suppressed reproduction during the last century, the genetic diversity in bighorn sheep herds has been lost (Schommer and Woolever 2001). At the present time there are no vaccines to protect bighorn sheep from developing pneumonia (Clifford et al. 2009, Schommer and Woolever 2001, Srikumaran et al. 2007, Weiser et al. 2003). The only way to prevent a pneumonia outbreak in bighorn sheep herds is to keep bighorn sheep separated spatially from domestic sheep and goats (Clifford et al. 2009, Dassanayake et al. 2008, Onderka et al. 1988, Schommer and Woolever 2001).

The separation, either spatially, temporally, or both, of bighorn sheep from domestic sheep has been recommended by leading bighorn sheep disease experts (Garde 2005, Schommer and Woolever 2001, Singer 2001). The Western Association of Fish and Wildlife Agencies defines effective separation as spatial and/or temporal separation between wild sheep and domestic sheep or goats resulting in, at most, minimal risk of potential association and subsequent transmission of respiratory disease between animal groups (WAFWA 2010). It is recommended that site-specific solutions for each bighorn sheep population and domestic sheep allotment be developed based on a management strategy appropriate for the complexity of the situation (Schommer and Woolever 2001). Each of the alternatives would take this approach; however, given the complexity of the issue in the Blue Mountains, each alternative would have pros and cons for minimizing the risk of contact between domestic and bighorn sheep.

Alternatives were evaluated on their merits for providing separation and minimizing likelihood of contact between domestic sheep and the 16 bighorn sheep populations within and adjacent to the Blue Mountains national forests.

Those alternatives that would provide the most summer source habitat in areas identified as unsuitable for domestic sheep grazing and the fewest acres of rangelands considered suited for domestic sheep grazing are considered the best options for bighorn sheep population persistence. The Wallowa-Whitman and the Umatilla National Forests would have a large portion of habitat in areas identified as unsuitable for domestic sheep grazing for all alternatives. Although the table displays acres of rangelands suitable for domestic sheep grazing, not all of those acres are currently being or would be grazed by domestic sheep. Many of the acres that could be grazed by domestic sheep are currently in cattle allotments, and, although technically they could be grazed by sheep, it would require a change in the type of livestock permitted on the allotment. For more information please refer to the “Terrestrial Wildlife Species Diversity and Viability” section of chapter 3.

### Forage Utilization by Livestock

Some authors have criticized using utilization data to make grazing land management decisions. Burkhardt (1997) claims that both utilization and stubble height methods are “likely the least effective management tool” and notes that these were developed to manage season-long grazing. Burkhardt also believes proper season of use and rest are far more effective for addressing most riparian grazing problems. McKinney (1997) notes the problems associated with measuring utilization when averages are calculated based on plant-by-plant observations. McKinney also maintains that overgrazing does not occur until after the grazing animal makes more than one visit to the plant.

Despite these criticisms there is no denying that estimating levels of utilization in order to achieve proper stocking rates has a long history in range management. Early authors investigated the effects of different stocking rates and utilization levels on above-ground biomass, forage production, cover, and other vegetation attributes, as well as livestock performance. Examples include Beetle et al. (1961), Cook (1977), Cooper (1953), Houston and Woodward (1966), Hyder (1951), Johnson (1953), Klipple and Costello (1961), Lang et al. (1956), Launchbaugh (1967), Lewis et al. (1956), Paulsen and Ares (1962), Pearson (1973), Pechanec and Stewart (1949), Pickford and Reid (1948), Skovlin et al. (1976), Smith (1967), Smoliak (1974), Valentine (1970), and Woolfolk (1949). These authors support using proper utilization levels to maintain and improve forage production and key species (Holechek 1988, Holechek 1998). For example, Cook (1977), working in sagebrush-grass range, concluded that 25 percent utilization on key forage plant species was reasonable for late spring and summer use and that 50 percent utilization was the maximum use that should occur in the winter. Skovlin et al. (1976) also reported that light stocking (34 percent for bluebunch wheatgrass and less for Sandberg bluegrass) provided a substantial increase in grazing capacity and better cattle gains per head than moderate or heavy stocking. It also provided the highest game density under dual use. Regarding sagebrush-bunchgrass range in southeastern Oregon, Hyder (1951) concluded, “… although 50 percent utilization is generally considered to be moderate, it probably represents excessive cropping on the range under consideration because of the large proportion of poor and fair range condition.”

Clary (1995) examined vegetation and soil responses to grazing simulation on riparian meadows and found that 10 cm or greater stubble height appears to be required to ensure full biomass production in mountain meadow sedge communities. He concluded, “If utilization guidelines are used, those rates that do not exceed 30 percent of the annual biomass production will likely maintain production the following year,” and that grazing these communities “once [growing] annually to a 5 cm stubble height in the spring, or to a 10 cm stubble height in late summer, or at a utilization rate exceeding 30 percent of the total annual biomass production can reduce herbage production significantly.” These recommendations apply only to maintaining or enhancing production and do not address the issues of stream bank stability and channel maintenance.

Holechek (1992) found that the most effective management strategy on Chihuahuan Desert rangelands was to use a conservative stocking rate (30 to 35 percent use of forage) and that this was a critical factor in the superior vegetation, livestock, and economic performance on the College Ranch at New Mexico State University compared to surrounding rangelands. Holechek (1993) summarized the importance of stocking rate and residues and concluded (Holechek et al. 1994) that conservative stocking (about 30 percent average use) can improve the herbaceous understory even on mesquite-infested range.

Hart et al. (1989 and 1993) found that proper stocking rates and grazing intensities were more important than grazing systems in improving rangeland vegetation in Wyoming. Hughes (1990) reported that on the Beaver Dam Slope Allotment (Arizona Strip District, BLM), downward trends were recorded between 1970 and 1982 at average utilization levels of 36 percent (ranging from 10 to 70 percent), while this same allotment showed an upward trend between 1981 and 1989 after utilization levels were adjusted to an average of 22 percent (ranging from 11 to 34 percent).

Holechek (2000) described conservative utilization as 31 to 40 percent and moderate as 41 to 50 percent and believed that managers should avoid heavy grazing (exceeding 50 percent). Holechek (2006) more recently concluded that in arid and semiarid areas, grazing can have positive impacts on forage plants compared to exclusion if average long-term use levels do not exceed 40 percent.

The lessons from these and other studies are that utilization levels that maintain long term health, recovery, and resilience to disturbance are highly variable and depend on site specific conditions; and the that stocking rates and grazing systems are important for improving rangeland conditions. The Blue Mountain Forests use forage utilization as a trigger for livestock management pasture moves for maintenance or improvement of resource conditions.

#### *Grazing after Wildfire*

The impacts of grazing management before and after a fire have a dramatic effect on the response of vegetation to the fire and to what can be expected in the long term. The need for increased intensity of grazing management on burned areas can be understood by realizing the potential change in the plant community and associated animal response that can result from a burn (Clark and Miller 2001).

The response of individual plant species to fire varies significantly between and within species. Moreover, this response is influenced by a variety of fire parameters, including intensity, severity (e.g., amount of organic matter consumed), residence time, soil heating, season of burn, and time since last fire. These parameters can vary significantly among fires and within a fire. These variations can and will cause differences in the response of individual species and the community as a whole. In addition, numerous physical and climatic factors (e.g., fuel condition, weather, slope, and aspect), as well as biological factors (plant morphology and physiology) will influence post-fire effects on plant communities. This includes direct effects, such as the ability of individual species to recover from the effects of fire.

Expected recovery potential is a function of fire severity. Johnson (1998) reported that in lightly burned areas (low severity fires) the expected recovery is fairly quick and a natural recovery of one to two years would be expected. Moderately burned areas (medium severity fires) have a modest recovery rate of two to five years. Heavily burned (high severity fires) have a slow natural recovery and may require five or more years to recover.

## Environmental Consequences – Grazing Land Vegetation

The following discussion describes the environmental consequences to grazing land and its relation to the significant issue of livestock grazing. The analysis considers the effects to grazing land in a landscape context and evaluates the alternatives in terms of the ability of the alternatives to contribute to grazing land health (e.g., sustainability, resilience, response to disturbance regimes, ability to maintain rangelands functionality relative to state and transition models).

### Indirect Effects

#### *Rangeland Vegetation Effects Common to all Three Forests*

**Alternative A**

The vegetation composition would be expected to maintain the current desired condition and trend.

Current data tends to indicate that recovery trends have slowed, although the exact reasons for this are not known. Some sites, primarily foothills (especially where impacted by nonnative plant species) and certain high elevation sites where historic impacts have exceeded a threshold, would continue to remain in poor to fair range condition (approximately corresponds to the early to low mid-seral status and/or phase D). In any case, assuming that approximate current permitted livestock levels and management would remain the same for alternative A, it is likely that upland rangeland conditions would continue their improvement on most sites. In some instances this improving trend would be impacted, and could even be reversed by invasive species, or in the longer term, by climate change. Conifer or other woody vegetation encroachment and over-story canopy cover would be expected to continue at a relatively unchanged pace. This will continue to impact grazing land health on those sites in or adjacent to the woody vegetation.

For alternative A the amount of rangeland in phases A through D is expected to remain unchanged, since recovery of native species on rangeland appears to have stabilized during the last 10 years (Countryman and Swanson, project record). Rangelands that are currently in phase C as a result of livestock grazing could show passive recovery if permitted livestock numbers are reduced. Rangelands that are currently in phase D are not expected to change as a result of decreased livestock numbers.

The description of the PACFISH and INFISH riparian management objectives (RMOs) as described in appendix A would be considered to be the desired conditions. These riparian conditions would remain similar to the existing conditions due to the goal statement (desired condition) from the 1990 forest plans that states that range ecosystems should be managed to ensure that the basic needs of the forage and soil resource are met. Forage production, above that needed for maintenance or improvement of the basic resources, would be made available to wildlife and permitted domestic livestock.

Effects to rangeland vegetation from wildfire may require rest from livestock grazing for a period of time to allow regrowth, depending on the severity of the fire.

**Alternative B**

The vegetation composition would be expected to maintain the desired condition and trend while meeting standards and guidelines.

Current rangeland condition (health and sustainability) would continue to improve across the landscape as it has in the recent past, but possibly at a slower rate. Recovery would be due in part to using the best available science for continued management of lands where livestock grazing is permitted. Some sites, primarily foothills (especially where impacted by nonnative plant species) and certain high elevation sites where historic impacts exceeded a threshold, would continue to remain in phases C and D. Due to budget constraints, as well as feasibility, restoration efforts would continue to be limited.

Implementation of alternative B would continue the trend towards improved rangeland vegetation conditions at about the same rate as alternative A. As with all alternatives, some areas would remain in phase D.

Riparian condition is in an upward trend across the Blue Mountains (Archer 2009, 2011). The maximum allowable utilization for riparian vegetation would be 40 percent, slightly lower than the 40 to 50 percent that alternative A would allow. The riparian vegetation upward trend would continue for all national forests.

Alternative B proposes that grazing after wildland fire should be managed so as not to cause a trend away from the key species desired condition. This may include growing season deferment for one or more years following wildland fire.

**Alternative C**

The vegetative composition would be expected to improve the desired condition in the riparian areas without permitted grazing.

Currently the allowable utilization of available forage on suitable grasslands is 50 to 55 percent. Alternative C would reduce this utilization to 30 percent. This would be a moderate to high change substantially decreasing the utilization in both riparian and uplands.

The effect of this alternative on rangelands would generally be minimal to moderate, given that the available information (range transect data, CVS plots, PIBO monitoring) indicates that current grazing management at the scale of the Blue Mountains has led to an improvement of both upland and riparian conditions. Some of these areas may show a fairly rapid recovery initially that would slow over time.

Implementation of alternative C would continue the trend towards improved rangeland vegetation conditions. Sites where livestock grazing is controlling the transition to an alternate phase would likely transition as a result of the decrease in suitable grazing land in this alternative. As with all alternatives, some areas would remain in phase D.

Riparian areas and subwatersheds with habitat for listed fish species would be unsuitable for permitted livestock grazing. This loss of area for permitted livestock and the change to riparian vegetation utilization to 10 percent would be expected to result in the most rapid short-term recovery of riparian areas and wetlands. Total livestock removal would be likely to benefit very specific riparian areas that may not be recovering as fast due to livestock grazing. Management Area 4B, Riparian Management Areas, is considered unsuitable for livestock grazing and would remove riparian acres from the suitable land base.

Alternative C proposes that grazing after wildland fire should be deferred until vegetation recovers to a condition where grazing will not cause the percent composition of native species to be reduced (cause a likely downward trend in key species). This generally will be a minimum of 5 years, but could be up to 10 years depending on the extent and severity of the fire and other factors.

**Alternative D**

The vegetative composition would be expected to maintain the desired condition while meeting standards and guidelines.

Currently the allowable utilization of available forage on suitable grasslands is 50 to 55 percent. Alternative D would reduce this utilization to 40 to 50 percent. This would be a modest change with a limited effect since utilization in the uplands does not exceed 35 to 40 percent in most active allotments.

Implementation of alternative D would continue the trend towards improved rangeland vegetation conditions. Additional AUMs for cattle and narrower riparian management areas may slow recovery at a site specific scale. Areas where off-road use impacted rangeland vegetation would start to recover and as with all alternatives, some areas would remain in phase D.

There could be an increase in riparian acres affected by livestock grazing, but the allowable riparian vegetation utilization would be the same as for alternative B. However, riparian management areas (MA 4B) would be narrower than for the other alternatives (100 feet on either side of a fish-bearing stream compared to 300 feet for all other alternatives; see details in appendix A). While the standards and guidelines that apply to MA 4B for all other alternatives apply to this alternative as well, the number of acres in this management area would be applied to a smaller area, which could lead to some impacts in the riparian zone (such as locating new livestock handling facilities, which should be placed outside of MA 4B (RMA-RNG-1)).

Effects to rangeland vegetation from wildfire may require rest from livestock grazing for a period of time to allow regrowth, depending on the severity of the fire.

**Alternative E and F**

The vegetative composition would be expected to maintain the desired condition and trend while meeting standards and guidelines.

Currently the allowable utilization of available forage on suitable grasslands is 50 to 55 percent. Alternatives E and F would reduce this utilization to 35 to 45 percent. This would be a modest change with a limited effect since utilization in the uplands does not exceed 35 to 40 percent in most active allotments.

Improvement and maintenance of rangeland health, sustainability, and resilience would also remain approximately the same.

Implementation of alternatives E and F would continue the trend towards improved rangeland vegetation conditions. Slightly more restrictive utilization guidelines in alternatives E and F may result in slightly fewer numbers of permitted livestock than alternatives A. As with all alternatives, some areas would remain in phase D.

Riparian vegetation is in an upward trend across the Blue Mountains (Archer 2009, 2011). The maximum allowable utilization for riparian vegetation for these alternatives would be 40 percent, slightly less than the 40 to 50 percent that would be allowed for alternative A. The riparian vegetation upward trend would continue for all national forests.

Alternatives E and F propose that grazing after wildland fire should be managed so as not to cause a trend away from the key species desired condition. This may include growing season deferment for one or more years following wildland fire.

## Environmental Consequences – Livestock Grazing

The alternatives vary in regard to several parameters affecting livestock grazing including acres suitable for grazing, AUMs, riparian management, suitability, proximity of domestic sheep to bighorn sheep, and post-fire guidance.

### Indirect Effects

#### *Suitability and AUMs*

**Malheur National Forest**

Alternative B would have the most acres suitable for permitted cattle grazing in active allotments and the most cattle AUMs. Alternative A would have the most acres suitable for permitted sheep grazing in active allotments, although it is not significantly greater than the acres that would be suitable for alternatives B, D, E, and F. With the exception of alternative C, the alternatives would have the same number of permitted sheep AUMs. Alternative C would have approximately 81 percent less AUMs.

Table 89 displays the comparison of the key indicators used to evaluate the livestock grazing and grazing land vegetation issue by alternative for the Malheur National Forest.

**Table 89. Malheur National Forest livestock grazing indicators for each alternative**

| Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| Acres suitable for permitted cattle grazing in active allotments | 1,197,000 | 1,225,000 | 620,000 | 1,216,000 | 1,197,000 | 1,197,000 |
| Acres suitable for permitted sheep grazing in active allotments | 102,000 | 101,000 | 55,000 | 101,000 | 101,000 | 101,000 |
| Permitted animal unit months (cattle) | 117,000 | 120,000 | 61,000 | 119,000 | 117,000 | 117,000 |
| Permitted animal unit months (sheep) | 6,500 | 6,500 | 1,200 | 6,500 | 6,500 | 6,500 |

**Umatilla National Forest**

Alternative B would have the most acres suitable for permitted cattle grazing in active allotments and the most cattle AUMS. Alternatives A, D, E, and F would have an equal number of acres suitable for cattle grazing, or about 96 percent of the acres that would be suitable for alternative B. Alternatives A, D, E, and F would have an equal number of cattle AUMS, or about 97 percent of the cattle AUMs that would be available for alternative B. Alternative C would have approximately half as many suitable acres and approximately 10 percent of the cattle AUMS as alternative B would have.

Alternative A would have the most acres suitable for permitted sheep grazing and the most sheep AUMs. Of the remaining alternatives, alternatives D, E and F would have the most acres suitable for sheep grazing along with the most sheep AUMs. Alternative B would have about half as many suitable acres as alternative A and about 59 percent of the sheep AUMs that would be available for alternative A. Alternative C would have about 22 percent of the suitable acres and about 15 percent of the sheep AUMs that alternative A would have.

Table 90 displays the comparison of the key indicators used to evaluate the livestock grazing and grazing land vegetation issue by alternative for the Umatilla National Forest.

**Table 90. Umatilla National Forest livestock grazing indicators for each alternative**

| Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| Acres suitable for permitted cattle grazing in active allotments | 284,000 | 298,000 | 30,000 | 284,000 | 284,000 | 284,000 |
| Acres suitable for permitted sheep grazing in active allotments | 60,000 | 28,000 | 13,000 | 42,000 | 42,000 | 42,000 |
| Permitted animal unit months (cattle) | 30,000 | 31,000 | 3,000 | 30,000 | 30,000 | 30,000 |
| Permitted animal unit months (sheep) | 7,800 | 4,600 | 1,200 | 5,800 | 5,800 | 5,800 |

### Wallowa-Whitman National Forest

Alternative D would have the most acres suitable for permitted cattle grazing in active allotments and the most cattle AUMs. Alternative A would have the most acres suitable for permitted sheep grazing, and alternatives A and D (equal amounts) would have the most sheep AUMs. The remaining alternatives would have equal sheep AUMs.

Table 91 displays the comparison of the key indicators used to evaluate the livestock grazing and grazing land vegetation issue by alternative for the Wallowa-Whitman National Forest.

**Table 91. Wallowa-Whitman National Forest livestock grazing indicators for each alternative**

| Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| Acres suitable for permitted cattle grazing in active allotments | 408,000 | 393,000 | 135,000 | 422,000 | 408,000 | 408,000 |
| Acres suitable for permitted sheep grazing in active allotments | 25,000 | 22,000 | 22,000 | 25,000 | 25,000 | 25,000 |
| Permitted animal unit months (cattle) | 77,000 | 74,000 | 26,000 | 80,000 | 77,000 | 77,000 |
| Permitted animal unit months (sheep) | 4,500 | 3,500 | 3,500 | 4,500 | 3,500 | 3,500 |

### *Amount and Percent of National Forest System land in Active Grazing Allotments*

**Alternative A**

No change would be expected in the amount and percentage of National Forest System land in active grazing allotments.

**Alternative B**

Completing the Rescission Act schedule for range AMP NEPA would potentially increase acres and percent of suitable grazing land if vacant allotments become active. This analysis and subsequent decision to convert a vacant allotment to active would be done at the project level.

**Alternative C**

Completing the Rescission Act schedule for range AMP NEPA would potentially increase acres and percent of suitable grazing land if vacant allotments become active. This analysis and subsequent decision to convert a vacant allotment to active would be done at the project level.

**Alternative D**

This alternative includes the vacant allotments in the suitable land base. Completing the Rescission Act schedule for range AMP NEPA would potentially alter acres and percent of suitable grazing land if vacant allotments or portions of the vacant allotments are determined to be unsuitable. This analysis and subsequent decision regarding actual suitable acres of the vacant allotments would be done at the project level.

**Alternative E and F**

Completing the Rescission Act schedule for range AMP NEPA would potentially increase acres and percent of suitable grazing land if vacant allotments become active. This analysis and subsequent decision to convert a vacant allotment to active would be done at the project level.

### *Acres in Active Allotments Suitable and Capable For Grazing*

**Alternative A**

No change would be expected in the acres of rangeland and grazable forestland suitable for cattle and sheep grazing.

This alternative would have a single standard:

- Do not stock livestock allotments in bighorn sheep range with domestic sheep (Malheur National Forest)
- Manage the conflict between bighorn sheep and domestic sheep in coordination with state wildlife agencies (Umatilla and Wallowa Whitman National Forests)

**Alternative B**

Suitable acres for sheep would be slightly reduced to minimize the risk of potential disease transmission from domestic sheep to bighorn sheep. Suitable acres for cattle would not be expected to change. Suitable acres for sheep would be slightly reduced to minimize the risk of potential disease transmission from domestic sheep to bighorn sheep. RNG 13 would be a Guideline of trailing of domestic sheep or goats should not be authorized or allowed within 7 miles of bighorn sheep home ranges.

**Alternative C**

Suitable acres for cattle and sheep would be expected to decrease due to the riparian buffers being designated as unsuitable for livestock grazing. Suitable acres for sheep would decrease more than the other alternatives due to the institution of the bighorn sheep ram maximum foray distance buffer designation for unsuitable domestic sheep grazing.

RNG 13 would be a Standard of trailing of domestic sheep or goats should not be authorized or allowed within 7 miles of bighorn sheep home ranges.

Approximately 60 percent of currently active cattle grazing allotments would be unsuitable for livestock grazing. This suitability determination would be implemented through project level analysis and decisions. This would eventually result in a corresponding decrease in permitted AUMs as displayed in table 89 through table 91.

**Alternative D**

This alternative would designate more acres as suitable for cattle because the riparian management areas would be the smallest. However, suitable acres for sheep would be slightly reduced to minimize the risk of potential disease transmission from domestic sheep to bighorn sheep.

RNG 13 would be a Standard of trailing of domestic sheep or goats should not be authorized or allowed within 7 miles of bighorn sheep home ranges.

Small increases in acres in active allotment status with a corresponding slight to moderate increase in permitted livestock numbers and AUMs could occur. Actual modifications to management and stocking would be dependent on the outcome of project-level planning and decisions and would be based in part on budget levels that would allow for more intense management in specific situations, as well as for stocking of some vacant allotments. Overall, projected increases are relatively small and would not be expected to result in major effects.

**Alternative E and F**

Suitable acres would not change for cattle; however, suitable acres for sheep would be slightly reduced to minimize the risk of potential disease transmission from domestic sheep to bighorn sheep.

Suitable acres for sheep would be slightly reduced to minimize the risk of potential disease transmission from domestic sheep to bighorn sheep. RNG 13 would be a Standard of trailing of domestic sheep or goats should not be authorized or allowed within 7 miles of bighorn sheep home ranges.

Overall, the permitted cattle AUMs would remain approximately the same and any actual modifications to management and stocking would be dependent on the outcome of project-level planning and decisions.

### *AUMs for Cattle and Sheep*

**Alternative A**

No change is expected in cattle and sheep AUMs.

**Alternative B**

AUMs for sheep would be slightly reduced to minimize the risk of potential disease transmission from domestic sheep to bighorn sheep. AUMs for cattle would not be expected to change.

**Alternative C**

AUMs for cattle and sheep would be expected to decrease due to the riparian buffers being designated as unsuitable for livestock grazing. Sheep AUMs would decrease more than the other alternatives due to the institution of the bighorn sheep ram maximum foray distance buffer designation for unsuitable domestic sheep grazing.

**Alternative D**

This alternative would designate more AUMs for cattle because the riparian management areas would be the smallest. However, AUMs for sheep would be slightly reduced to minimize the risk of potential disease transmission from domestic sheep to bighorn sheep.

This alternative would designate more acres as suitable for cattle because the riparian management areas would be the smallest. However, suitable acres for sheep would be slightly reduced to minimize the risk of potential disease transmission from domestic sheep to bighorn sheep.

**Alternative E and F**

AUMs would not change for cattle; however, AUMs for sheep would be slightly reduced to minimize the risk of potential disease transmission from domestic sheep to bighorn sheep.

Suitable acres for sheep would be slightly reduced to minimize the risk of potential disease transmission from domestic sheep to bighorn sheep.

### *Grazing after Wildfire*

**Alternative A**

Alternative A would not include post-fire guidance for livestock grazing. Depending on fire intensity, grazing may be modified. Desired conditions for rangeland vegetation would guide management activities.

**Alternative B**

Alternative B would create a Guideline that grazing after wildland fire should be managed so as not to cause a trend away from the key species desired condition. This may include growing season deferment for one or more years following wildland fire. Depending on the size and severity of the wildfire, this could affect one or more pastures, or the entire allotment in the short term. In the long term, forage vigor and quality may be improved.

**Alternative C**

Alternative C would create a Standard that grazing after wildland fire shall be deferred until vegetation recovers to a condition where livestock grazing will not cause the percent composition of native species to be reduced (cause a likely downward trend in key species). This generally will be a minimum of 5 years, but could be up to 10 years depending on the extent and severity of the fire and other factors. This alternative would provide rangeland vegetation with the greatest opportunity to recover from wildland fire. Depending on the size and severity of the wildfire, this could affect one or more pastures, or the entire allotment. This may be a very negative impact or hardship on the permittee(s) if there are no available vacant allotments they could occupy during this extended rest period.

**Alternative D**

Alternative D would not include post-fire guidance for livestock grazing. Rangeland vegetation desired conditions would guide management activities.

**Alternative E and F**

Alternatives E and F would create a Guideline that grazing after wildland fire should be managed so as not to cause a trend away from the key species desired condition. This may include growing season deferment for one or more years following wildland fire. Depending on the size and severity of the wildfire, this could affect one or more pastures, or the entire allotment in the short term. In the long term, forage vigor and quality may be improved.

## Cumulative Effects

The analysis area for cumulative effects includes all 14 counties of the Blue Mountains, including lands administered by other federal agencies (BLM, BIA) tribal lands, state lands, and private lands. Grazing lands throughout the project area have been and continue to be subject to a wide variety of impacts. Many ranchers depend on allotments administered by the Forest Service and Bureau of Land Management to provide a portion of their year-round grazing operations. As private land continues to be developed and property values continue to increase, the desirability and feasibility of some allotments used for livestock production could decline. The project area includes an accumulation of diverse and highly dynamic land with extensive site specific characteristics that respond to each impact in a distinctive manner and within a unique and often unknown timeframe. It is essential to understand the legacy of historical impacts in order to make informed decisions on changes to rangeland management direction (as reflected within the alternatives). Additionally, understanding the historical impacts is important to consider in the context of attempting to maintain or achieve desired conditions. These impacts, taken together as past, present, and reasonably foreseeable future effects, are cumulative effects.

### *Wildland Fire*

Fire is an intrinsic disturbance process in many rangeland ecosystems. Examples include:

- Aspen communities where fire is a key disturbance factor in regeneration and removal of conifer competition.
- Mountain big sagebrush communities where fire is a key disturbance factor in maintaining a mosaic of seral stages and age classes and in ensuring sustainability of an understory that can be overshadowed by sagebrush.

Other grazing lands are not necessarily dependent on fire as a key disturbance but have adapted to thrive in the presence of periodic fire or other disturbance, such as drought or insect infestations. Most grazing land grass/forb communities are adapted to periodic vegetative material removal and regeneration and tend to be most healthy in the presence of periodic fire and disturbance. Until about the mid-1900s, natural fire played its natural role. In general, this periodic natural fire maintained canopy covers within natural ranges; allowed for mosaics of plant communities, seral stages, and age classes; and helped to stimulate new growth of grasses and to keep them healthy and thriving. Since the mid-1900s, humans restricted the occurrence and spread of natural fire. This has had the effect of allowing an increase in conifer canopy and the encroachment of conifers, juniper, or sagebrush into open grasslands or shrublands thereby decreasing herbaceous cover and impacting those species which required open sunny conditions. As canopies closed, the understory herbaceous and shrubby vegetation was reduced or lost. This impacted forage quantity, quality, and availability for native ungulates, as well as for permitted livestock. With this loss, forage harvest was concentrated even more on the open grasslands, shrublands or on riparian areas and wetlands.

Fire exclusion has had a significant effect on grazing land vegetation and this effect is expected to continue into the future in areas where increased urbanization has made the use of fire and the potential for natural fire more difficult.

Conversely, the use of prescribed fire has also had effects on grazing lands. In some instances, fire was used to control shrub vegetation (e.g., sagebrush or juniper) without a clear understanding of how natural fire would have affected plant communities. In other instances, fire was overused and impacted plant community health and sustainability. Additionally, fire use inadvertently favored the spread of invasive species, such as cheatgrass. For the most part, prescribed fire has had minimal and mostly short-term effects to rangeland resources, such as soils, vegetation, wildlife, and recreational or visual quality.

It is critical to allow rest from livestock grazing for recovery of the vegetation following any high intensity wild fire or prescribed fire. Lower intensity or mosaic prescribed fire tends to stimulate vegetative growth and is normally considered to have a positive effect on rangeland vegetation.

#### *Large Wild Ungulates*

During the past century-and-a-half or so, there have been significant changes in both the species and the population of large wild ungulates, such as deer, elk, and wild horses. Some changes have been a result of human decisions designed to increase populations of deer and elk. At times these actions worked too well with the effect that the population exceeded grazing capacity with negative and lasting impacts to the vegetation (and sometimes to the soils) in certain geographic areas. This has been demonstrated through the use of upland exclosures.

In some cases, wild ungulate populations increased to occupy available habitat niches. Elk are a prime example in the Blue Mountains with few if any elk present in the early 1900s and increased populations currently. The effect of this could increase the grazing pressure on forage and browse plants, especially when the increased wild ungulate population is added to permitted livestock. In general, the initially rapid reduction in permitted livestock (early 1900s) followed by a slower but continuing reduction in both permitted numbers, seasons of use, and areas open to livestock grazing has offset the increased effects of large wild ungulate use. However, this is not the case everywhere and the dual use results in both historic and current impacts to soils and forage resources in some areas. It is expected that this situation will continue with relatively stable large wild ungulate populations (with natural fluctuations) and a slow decline in permitted livestock (or in the case of some of the alternatives, a rapid and significant decrease in permitted livestock).

#### *Roads*

Most road construction occurred during the past 40 to 50 years. The construction of roads in the uplands was done to access management areas for timber harvest and forested vegetation activities. For the most part, these roads have few direct effects on grazing lands, but there can be a number of indirect and cumulative effects. Specifically, roads tend to act as significant vectors for the invasion or spread of invasive species. This is discussed in more detail in the access section but for the grazing lands vegetation assessment purposes, invasive species tend to have a very long lasting impact on grazing lands health (especially on disturbance regimes and resilience/sustainability). The effect of invasive species dates to the early to mid-1900s. Effects include competition with native grasses and forbs for space, water, and nutrients. In the most extreme examples, certain invasive species can replace native plant communities and result in a transition to phase D that may not respond to reasonable restoration efforts. Invasive species can and have also impacted fire regimes with the greatest impacts occurring to upland shrub communities (e.g., a cheatgrass infestation). However, upland roads have also altered water regimes to the extent that natural runoff is diverted or subsurface water flow is intercepted and then diverted. This can change local plant communities. In addition, it was common practice at one time to seed roads with nonnative species, such as smooth brome (*Bromus inermis*) or yellow blossom sweet clover (*Melilotus officialis*). These species have had an effect on native grazing lands vegetation, at times replacing native grasses and forbs on specific sites.

### *Recreation*

Increases in wildland recreation use have often paralleled the development of roads with four-wheel or backcountry driving becoming a significant impact in some areas. For the most part, early to mid-1900s recreation was limited to hunting and camping mostly along riparian areas. More recently recreation has increased with very significant increases in backcountry driving. As recreation uses of all kinds have increased, so too have the conflicts between uses and activities, such as permitted livestock grazing, as well as with desired vegetative conditions. Increases in recreation activity tend to be associated with increases in soil erosion, importation and spread of invasive plants or animals, and damage to rangeland vegetation, as well as an increase in livestock management gates left open, water developments damaged, and livestock harassed with a resultant loss in management control and effectiveness. With increasing urbanization and a desire for recreation on national forests, it would be expected that conflicts and impacts would continue and possibly increase.

### *Private Lands and Open Space*

Private lands within and associated with the plan area have historically been used for activities in conjunction with uses and activities on National Forest System lands. For example, all livestock grazing permits for the national forests are linked with private ranch lands through requirements for ownership of base property. In addition, most permit holders are dependent on national forest grazing permits to round out and make their overall operations economically viable. For a variety of reasons, public lands have seen a decline in the amount of forage authorized for use. This trend is anticipated to continue, although at a slower rate. Livestock operation costs are expected to continue rising and market prices will continue to fluctuate. This will result in economies of scale and some smaller operators may dispose of base properties due to financial reasons. In such cases allotments may be released and may or may not be incorporated into other allotments.

In general, National Forest System lands within the plan area can and are affected by management of the private lands. As ranches are sold and subdivided, there will continue to be a net loss of open space. Development of the private lands for home sites tends to increase impacts to the national forests for recreation, but there are also effects associated with loss of wildlife habitat and increases in invasive species infestation and spread. This has led to the relatively recent recognition of the importance of maintaining open space as an important component of wildlife habitat, maintenance of native biodiversity, and for social values offered by solitude. The open space offered by National Forest System lands becomes increasingly important, especially as private lands are developed for home sites.

### *Water Development and Uses*

Scattered through the project area are various kinds of water developments, including reservoirs for irrigation water and recreation; diversions, normally for irrigation but also for urban uses; and developments for livestock, recreation, and so forth. The impacts of these developments are difficult to describe and quantify relative to grazing lands, but, in general, diversion of water from one place to another tends to affect native vegetation and soils. Loss of water in one place can result in changes of vegetation to more xeric species while addition of water to other sites, such as along conveyance ditches, often results in increases in mesic vegetation and often in invasive species. The contrary also exists where water developments that were constructed for livestock use are now readily used and relied upon by wildlife, even to a greater extent than by livestock. Some of these developments have been in place for decades to a century or more, so the effects are well established. It is likely that there will be additional developments in the future, especially with the increased need to keep livestock off streams with federally listed fish.

### *Forested Vegetation Management*

Management of conifer vegetation over time has had important effects to grazing land vegetation. Historically, forested vegetation was manipulated by Native Americans through the use of fire to maintain a relatively open canopy. This often was based on maintaining ease of travel, as well as habitat for wildlife species used by the Native Americans for food and other needs. When Euro-Americans settled in the area, the most significant impacts would have been as a result of control of fire (e.g., increases in canopy cover with loss of understory herbaceous and shrubby vegetation or encroachment of conifers into rangelands). The early livestock management practices associated with heavy utilization and improper management resulted in a loss of fine fuels to carry fire and an increase in forested vegetation regeneration with no means of maintaining it at levels representative of the historic ranges. With early logging practices that tended to hi-grade mature timber (especially ponderosa pine and Douglas-fir), little thought was given to managing the residual forested vegetation or to reproduction for future forest health. The result again was a dramatic increase in canopy cover, encroachment into rangelands, and a general dramatic loss of herbaceous and woody understory species and forage production for both wildlife and livestock. More recently, forested vegetation management has moved to a longer-term focus of healthy forestlands, but there is a huge backlog of overstocked stands with little or highly altered understory herbaceous and shrubby vegetation. At the same time, a continuation of fire suppression practices has exacerbated this situation. In the future, it is likely that political restrictions on forested vegetation management, combined with restrictions on the use of wildland fire, are likely to result in a continuation of overstocked and/or closed canopy stands. The exceptions will probably be limited to those areas where there is active forested vegetation management, including practices, such as periodic thinning. The long-term effect of this is a reduction in understory vegetation relative to what likely occurred prior to the 1900s with a continuing loss of forage production and wildlife habitat. In part this means that the true rangelands (e.g., grasslands, shrublands, etc.) carry more of the wildlife and permitted livestock forage harvest than should occur.

### *Climate Change*

Climate change, primarily through increases in temperatures and $CO_2$, and changes in precipitation, likely will result in shifts in species composition and distributions of rangeland communities and thus also in forage production. Climate changes have resulted and will continue to result in earlier initiation of the growing season, longer growing season length, earlier plant senescence, mismatches between climate characteristics and plant phenology, and increased risk of drought and fire disturbance. In fact, rangeland systems in general may be an early indicator of climate change due to the dominance of grasses and forbs and, hence, their relatively higher sensitivity to annual climate variability compared to forestlands.

General increases in precipitation could result in expansion of woody species and shifts from grasslands to shrublands, or from grasslands and shrublands to woodlands and forests. Conversely, decreases in effective precipitation could cause declines in vegetation productivity and shifts from forests, woodlands, and shrublands to grasslands and deserts. Given enough water for growth, elevated $CO_2$ has the potential to increase rangeland plant productivity through increases in water-use efficiency. Native cool season species are positively affected by higher $CO_2$ levels, but so are some nonnative invasive plant species, such as cheatgrass, red brome, and others (Chambers and Pellant 2008).

Some species have the potential to migrate upslope with increases in temperature. However, habitat fragmentation and barriers to migration may impede many species from migrating to more suitable habitats in the north. Some native rangeland species may be displaced where climate change favors invasive species.

Rangelands will likely be affected by increasing amounts of wildfire but may still have fewer disturbances than occurred either historically (e.g., natural fire, Native American fire, wild ungulate grazing) or through Euro-American activities. Ecosystem disturbances can accelerate both loss of native species and invasion of exotics (Sala et al. 2000).

Changes in rangeland composition, structure, seasonality and productivity could have consequences for livestock grazing, including changes to the annual timing of grazing (e.g., earlier on- and/or off-dates), and reduced overall AUMs where forage production declines.

**Effects from the Alternatives** – The alternatives differ in their relative contributions to climate change adaptation primarily in the degrees they would restore ecosystem resilience, reduce uncharacteristic disturbance, and reduce barriers to species movement. Alternative D would have the most forest thinning and thus potentially the greatest reduction in uncharacteristic disturbance, followed by alternatives E and F. Alternative D would have the most invasive species eradication, thus reducing the risk of displacement of native species by nonnative invaders. Alternative C would have the greatest area allocated to designated wildlife corridors (MA 3C), followed by alternatives E and F, and would likely provide more favorable conditions for species migration than other alternatives.

# Issue 4: Old Forest

This section describes the affected environment and possible environmental consequences of the alternatives related to the old forest significant issue. Many commenters suggested an active approach to reducing the risk of loss of old forest from insects, disease, and wildfire, and to accelerate the development of old forest structure. Other people prefer the use of nonmechanical (non-timber harvest) means to restore old forests and the designation of old forest reserves where no significant timber harvest is allowed.

## Affected Environment

Old forest key indicators include:

- Acres of old forest within management area allocations with limited management activity
- Acres of vegetation treatments within old forest

- Change in old forest structure over time
  - Percent of each upland forest potential vegetation group (PVG) in the old forest single-story (OFSS) and old forest multi-story (OFMS) structural stages at year 50

While various definitions of old forest exist, it is important to note that old forest does not refer to an individual, old tree or even a scattering of old trees. Old forest is a late stage of stand development that develops over a relatively long period of time. The age at which old forest develops and the specific structural attributes that characterize old forest will vary widely according to forest type, climate, site conditions, and disturbance regime (USDA Forest Service 1993). While old forest is mainly distinguished from younger growth by having an abundance of physiologically old trees (for the species and site conditions) that are dominant in the overstory and are usually larger in diameter, other characteristics include variation in tree sizes and spacing, accumulations of large-size dead standing and fallen trees that are high relative to earlier structural stages, decadence in the form of broken or deformed tops or boles and root decay, canopy gaps, and understory patchiness (USDA Forest Service 1993).

Compositionally, old forest encompasses both older forests dominated by shade-intolerant species, which are fire-dependent, and forests near climax stages dominated by shade-tolerant species. Old forest may be single-story (typically shade-intolerant) or multi-story (typically shade tolerant). Rates of change in composition and structure are slow, relative to younger forests. Different stages or classes of old forest are recognizable in many forest types. Old forest is not necessarily virgin or primeval. Old forests have developed following human disturbances, including timber harvest (Kolb 2007). The structure and function of an old forest ecosystem is influenced by its stand size, structure, disturbance regime, species composition, and its position on the landscape.

The Blue Mountains were historically well known for vast expanses of old forest single-story ponderosa pine that dominated the landscape, as well as old moist and cold upland forest. Frequent, low severity and mixed severity wildfire was one of the dominant forces that historically created and maintained these stands. Infrequent, high severity fire was a dominant force influencing old forest in the high elevation cold upland forest environments. Insect and disease disturbances were also important in creating small scale, as well as larger scale, contributions to the downed wood and standing dead tree component of old forest. The variation in size, intensity, and frequency of these disturbances contributed to a pattern of old forest that was probably not stable on the landscape (Hessburg et al. 2005). Old forest positioning on the landscape was not static historically. Rather, old forest probably shifted spatially over time. As some old forest stands succumbed to high severity disturbances, other areas were progressing from mid-aged and mature forest into old forest.

Due to past harvest and wildfire (see the Forested Vegetation, Timber Resources, and Wildland Fire section for historic overview), the percent of the dry upland forest potential vegetation group in the old forest single-story open canopy structural stage is far less than levels that occurred prior to 1900. The percent of the moist and cold upland forest potential vegetation groups in old forest structural stages is closer to the pre-1900 levels, in comparison to the dry upland forest potential vegetation group (Countryman and Justice 2008).

Public forests are facing new challenges caused, in part, by expectations that forests provide a myriad of services along with products, while maintaining old forests. In the 1990s, people were recognizing that historic forest structure and patterns were fluid across the landscape due to natural disturbances (Rogers 1996). As management emphasis of public lands moved towards restoration and historical range of variability (HRV), managers recognized the need to mimic natural disturbances (Ontario Ministry of Natural Resources Forest Management Branch 2001, Mitchell et al. 2002, Sarr et al. 2004). Reliance on designated old growth management areas (OGMA) has now been determined to be ineffective to meet the needs of wildlife species dependent on old forest because the concept ignores the role of historic disturbance regimes and the shifting of old forest across the landscape. Additionally, as pointed out by Simberloff (1987) and displayed in table 92, not all of the areas identified as OGMAs actually contain old growth. Klenner et al. (2000) demonstrated that when natural disturbance is taken into account, the loss of old growth from designated OGMAs due to wildfire indicates that maintaining old growth solely on the limited OGMA landbase is a risk-prone strategy. They state: “maintaining a specific feature may at best be highly uncertain, or at worst, detrimental to planning for long-term objectives as it creates a false sense of security about the future landscape condition.”

A wide spectrum of social values is associated with old forests. Various groups of people find old forests aesthetically pleasing, ecologically important, intrinsically and economically valuable, and necessary for a resilient and sustainable landscape. Additionally, public forests are facing new challenges caused, in part, by expectations that forests provide a myriad of services along with products, while maintaining old forests.

The Forested Vegetation, Timber Resources, and Wildland Fire section of this document also discusses the existing condition of old forest in the Blue Mountains and the effects of the alternatives on the amount of old forest over time. This section summarizes that information and describes the management approaches for old forest by alternative. The Terrestrial Wildlife Species Diversity and Viability section discusses the importance of old forest as habitat and the effects of the alternatives on wildlife species that depend on old forest.

## Existing Condition

Table 97, table 98, and table 99 display the existing amounts of old forest structural stages within each national forest. Within the Malheur National Forest, approximately 25 percent of all upland forest potential vegetation groups (cold, moist, and dry) are currently in old forest structural stages (OFSS and OFMS). Approximately 1 percent of the cold upland forest potential vegetation group, 3 percent of the dry upland forest, and 5 percent of the moist upland forest are in the old forest single story (OFSS) structural stage. Approximately 20 percent of the cold upland forest potential vegetation group, approximately 20 percent of the dry upland forest potential vegetation group, and 47 percent of the moist upland forest potential vegetation group are in the old forest multi-story (OFMS) structural stage.

Within the Umatilla National Forest, approximately 30 percent of all upland forest potential vegetation groups (cold, moist, and dry) are currently in old forest structural stages (OFSS and OFMS). Little or no (approximately 0 percent) of the cold upland forest potential vegetation group, approximately 4 percent of the dry upland forest potential vegetation group, and approximately 23 percent of the moist upland forest potential vegetation group are in the OFSS structural stage. Approximately 30 percent of the cold upland forest potential vegetation group, approximately 8 percent of the dry upland forest potential vegetation group, and approximately 32 percent of the moist upland forest are in the OFMS structural stage.

Within the Wallowa-Whitman National Forest, approximately 32 percent of all upland forest potential vegetation groups (cold, moist, and dry) are currently in old forest structural stages (OFSS and OFMS). Approximately 1 percent of the cold upland forest potential vegetation group, 1 percent of the dry upland forest potential vegetation group, and 1 percent of the moist upland forest potential vegetation group are in the OFSS structural stage. Approximately 34 percent of the cold upland forest potential vegetation group, approximately 14 percent of the dry upland forest potential vegetation group, and approximately 25 percent of the moist upland forest potential vegetation group are in the OFMS structural stage.

Of the approximately one million acres of old forest located within the Blue Mountains, less than 400,000 acres are located within a management allocation that has a significant potential to be treated using active timber management (areas with developed road systems and suitable for timber production). All acres of old forest would be potentially available to be managed using fire, depending on the potential of that activity to be compatible with moving the landscape toward the desired conditions.

#### *Historic Estimates of Old Forest Abundance Compared to the Existing Condition*

Within all three national forests, the percent of the moist and cold upland forest potential vegetation groups in old forest structural stages is less departed from the HRV, in comparison to the dry upland forest potential vegetation group (Countryman and Justice 2008). The percent of the dry upland forest potential vegetation group in the old forest single-story (OFSS) structural stage is far less than levels that occurred historically due to interruption of the historical fire regime, past timber harvest, and uncharacteristically severe wildfire (see the Forested Vegetation, Timber Resources, and Wildland Fire section for historic overview).

Table 231 and table 232 display the existing forested structural stages (percent of potential vegetation group) and the HRV/desired conditions by national forest within each upland forest potential vegetation group. Within the Malheur cold upland forest potential vegetation group, the percent of the landscape in the OFSS stage is below the HRV, while the percent of the landscape in the OFMS stage is within the HRV. Within the Malheur dry upland forest potential vegetation group, the percent of the landscape in the OFSS stage is below the HRV, while the percent of the landscape in the OFMS stage is above the HRV. Within the Malheur moist upland forest potential vegetation group, the percent of the landscape in OFSS stage is below the HRV, while the percent of the landscape in the OFMS stage is above the HRV.

Within the Umatilla cold upland forest potential vegetation group, the percent of the landscape in the OFSS stage is below the HRV, while the percent of the landscape in the OFMS stage is above the HRV. Within the Umatilla dry upland forest potential vegetation group, the percent of the landscape in the OFSS stage is below the HRV, while the percent of the landscape in the OFMS stage is within the HRV. Within the Umatilla moist upland forest potential vegetation group, the percent of the landscape in the OFSS and OFMS stages are above the HRV.

Within the Wallowa-Whitman cold upland forest potential vegetation group, the percent of the landscape in the OFSS stage is below the HRV, while the percent of the landscape in the OFMS stage is above the HRV. Within the Wallowa-Whitman dry upland forest potential vegetation group, the percent of the landscape in the OFSS stage is below the HRV, while the percent of the landscape in the OFMS stage is above the HRV. Within the Wallowa-Whitman moist upland forest potential vegetation group, the percent of the landscape in the OFSS stage is below the HRV, while the percent of the landscape in the OFMS stage is above the HRV.

#### *Current Old Forest Management Direction Specific to Each National Forest*

Current management direction for timber sales within all three national forests is partly derived from the Interim Management Direction Establishing Riparian, Ecosystem, and Wildlife Standards for Timber Sales (Eastside Screens), which was added to the 1990 forest plans by amendment in 1995. The Eastside Screens provides management direction for late and old structure (LOS; see appendix A). In the forest plan revision analysis, late and old structure is referred to as old forest. The Eastside Screens requires national forests to manage old forest within the HRV that occurred pre-1850. Harvest is allowed within old forest stands when the amount of old forest is within or above the HRV, but not when it is below the HRV. Besides direction to manage old forest within HRV, the Eastside Screens includes the following management direction related to the individual large diameter trees: “When LOS is below HRV, maintain all remnant late- and old-seral (LOS) and/or structural live trees greater than 21 inches d.b.h. that currently exist within stands proposed for harvest activities.” See the Forested Vegetation, Timber Resources, and Wildland Fire section for further discussion of HRV.

The current amount of old forest (inside and outside of old forest management areas) is much greater than the amount that was predicted when the 1990 forest plans were approved. At that time, significant amounts of old forest were expected to be harvested during the next two decades. The implementation of the 1993 Eastside Screens caused the harvest of large trees to effectively cease within the three national forests, virtually halting the conversion of old forest to young forest. In some cases, the Eastside Screens also prevented the conversion of OFMS to OFSS.

The Eastside Screens management direction does not include designation of management areas for old forest, but applies wherever old forest occurs on the landscape.

### *Old Growth Management Areas*

All three national forests currently have management allocations for old forest as displayed in table 92.

**Table 92. Old forest structure within 1990 forest plans designated old forest management areas**

| National Forest | Acres in Old Forest Management Areas | Actual Old Forest Structure within Old Forest Management Areas* |
|---|---|---|
| MAL | 84,232 | 33,000 acres (39%) |
| UMA | 44,277 | 13,000 acres (22%) |
| WAW | 60,285 | 21,000 acres (35%) |

* Based on GIS current old forest management areas and existing vegetation layer.

Table 92 displays actual acres of old forest structure with current old forest management areas. Actual acres of old forest structure were determined by forest plan monitoring surveys (1995 to 2003 walk-through survey data), as well as data on existing vegetation conditions. The table shows that many dedicated old forest management areas are not currently meeting the intent of the forest plans for old forest. For example, within the Wallowa-Whitman National Forest, only 35 percent of dedicated old forest management areas currently exhibit old forest structure and meet the forest plan old forest definitions. Additionally, the size of current dedicated old forest areas may be inadequate to meet the habitat requirements for which they were established.

Many areas allocated to old forest in the 1990 forest plans did not meet the definition initially and were chosen to meet patch size and distribution requirements or expected to grow into old forest. These areas were not necessarily chosen because they were the best old forest available in the area. Over the past 20 years, old forest allocations have been affected by disturbances, such as fire, windthrow, insects, and diseases. In some instances, acres dedicated to old forest management areas have experienced vegetation species composition or forest structure changes due to disturbances; however, these acres are still allocated to old forest management areas.

### *Existing Management Direction for the Malheur National Forest*

The Malheur forest plan (1990) describes old growth (management area 13) as composed of mature/over mature sawtimber (150 years old or older), which provides habitat for wildlife species dependent on mature/over mature forest conditions, provides for ecosystem diversity, and provides for the preservation of aesthetic qualities.

**Existing Goal:** Provide "suitable" habitat for old growth dependent wildlife species, ecosystem diversity, and preservation of aesthetic qualities.

Current activity restrictions within Management Area 13:

- Identified as unsuitable for timber management
- Motor vehicle use is restricted to open roads and trails
- New road construction should avoid old growth stands

### *Existing Management Direction for the Umatilla National Forest*

Under current management direction, old forest is allocated to two management areas: Dedicated Old Growth and Managed Old Growth. The goal of dedicated old growth is to provide and protect sufficient suitable habitat for wildlife species dependent upon mature and/or over-mature forest stands and to promote a diversity of vegetative conditions for such species. The goal of managed old growth is to provide and protect sufficient suitable habitat for wildlife species dependent upon mature and over mature lodgepole pine forest stands and to promote a diversity of vegetative conditions for such species. Fuels treatments are permitted to maintain or enhance old growth habitat characteristics or reduce the potential for a large number of acres burned or high severity burns.

Current activity restrictions include:

- Motor vehicle use is restricted to open roads and trails
- New road construction should avoid old growth stands where feasible and practical
- Dedicated old growth: Timber management and harvest activities are not permitted
- Managed old growth: Timber harvest activities are permitted for the purpose of enhancing wildlife habitat

### *Existing Management Direction for the Wallowa-Whitman National Forest*

Under current management direction, this management area was allocated for the preservation of old forest (old growth in the current forest plan). It is intended to maintain habitat diversity, preserve aesthetic values, and to provide old-growth habitat for wildlife. Although the forest plan allocates 36,750 acres to this management area, maps of the allocations were not finalized at the time the plan was signed and later mapping of this allocation showed that it includes 60,285 acres.

Current activity restrictions:

- Unsuitable for timber management
- Timber harvest, including salvage, may occur
- New road construction should avoid old growth

## Design Elements for the Action Alternatives

The intent of all burning and timber harvesting treatments would be to improve ecological resiliency by:

- favoring shade intolerant species, such as ponderosa pine and western larch, (according to the desired conditions for species composition),
- reducing stand densities within the dry upland forest potential vegetation group (according to the desired conditions for stand densities),
- reducing the abundance of multi-storied stands on the landscape (according to the desired conditions for forested structural stages),
- increasing the percent of the landscape in old forest structural stages (according to the desired conditions for forested structural stages), and
- decreasing the potential for uncharacteristically severe insect and fire effects.

The majority of treatments would occur in the dry upland forest potential vegetation group, with fewer treatments being applied in the moist and cold upland forest potential vegetation groups (see aapendix B, table B-11).

Under all of the action alternatives, management of old forest would be guided by the desired conditions for forested structural stages. The desired conditions for the percent of each upland forest potential vegetation group in the OFSS and OFMS stages are displayed in table 93. Management of old forest would also be guided by the desired conditions for other structural and functional attributes, such as stand density, species composition, fire regime condition class (FRCC), fire severity, insect and disease risk hazard, and landscape patterns.

**Table 93. Desired conditions for old forest (percent of landscape)**

| Potential Vegetation Group | Old Forest Single Story | Old Forest Multi-story |
|---|---|---|
| Cold upland forest | 5-20% | 10-25% |
| Moist upland forest | 10-20% | 15-20% |
| Dry upland forest | 40-65% | 1-15% |
| Dry upland woodland | 20-40% | 30-50% |

See the “Forested Vegetation, Timber Resources, and Wildland Fire” section for more discussion of forested structural stages desired conditions.

### *Design Elements Specific to Alternative B*

Alternative B would not include a specific land management area allocation for old forest. Like the Eastside Screens direction in alternative A, alternative B would manage old forest where it exists on the landscape. Many older forest stands that do not yet meet the definition of old forest (as defined in the Forest Service Region 6 Interim Old Growth Definition green-book) would become old forest over time. Some old forest stands would be affected by disturbances and would no longer meet the definition of old forest or provide old forest habitat requirements. The management direction in this alternative would contain flexibility which would allow forest stands to be managed for their structural stage, regardless of their management allocation.

Old forest would not be included in lands suitable for timber production and would not contribute to the allowable sale quantity. Because of a deficit of old forest structure within the Blue

Mountains and viability concerns for species that depend on that resource, even-aged management regeneration harvests would not be scheduled within current old forest stands. Under alternative B, timber harvest in old forest stands could utilize uneven-aged management single tree selection and small group selection harvests or various thinning methods. Alternative B would contain a guideline that would prohibit new road and trail construction in old forest.

### *Design Elements Specific to Alternative C*

Under alternative C, old forest stands outside of wilderness and backcountry areas would be designated and placed into an old forest land management allocation (MA 4C Old Forest). Table 94 displays the acres of old forest that would be allocated to MA 4C Old Forest Management Areas under alternative C. These acres would be allocated in areas that would otherwise be allocated to MA 4A General Forest. As forest stands change over time, some acres in MA 4C would no longer be old forest, while other acres outside of MA 4C would become old forest. Under alternative C, old forest stands would be considered unsuitable for timber production and timber harvest. No commercial harvest would occur within these old forest management areas, but prescribed fire and harvesting of smaller diameter trees would be allowed. Treatments within MA 4C would consist mostly of thinning trees less than 8 inches d.b.h. Alternative C would contain a standard that would prohibit new road and trail construction in old forest.

**Table 94. MA 4C old forest acres for alternative C for each national forest**

| National Forest | MA 4C Acres |
|---|---|
| MAL | 205,391 |
| UMA | 95,177 |
| WAW | 106,263 |

### *Design Elements Specific to Alternative D*

Alternative D would not include a specific land management area allocation for old forest. Alternative D would manage old forest where it exists on the landscape. Many old forest stands that do not currently meet the definition of old forest (as defined in the Forest Service Region 6 Interim Old Growth Definition green-book) would become old forest over time. Some old forest stands would be affected by disturbances and would no longer meet the definition of old forest or provide old forest habitat requirements. The management direction in this alternative would contain flexibility which would allow forest stands to be managed for their structural stage regardless of their management allocation.

Under alternative D, old forest would be included in lands suitable for timber production and would contribute to the allowable sale quantity, where old forest stands within general forest (MA 4A) may be suitable for timber production. However, timber harvest under alternative D would not convert old forest to non-old forest because of a deficit of old forest structure within the Blue Mountains and viability concerns for species that depend on that resource. Even-aged management regeneration harvests would not be scheduled within current old forest stands. Under alternative D, timber harvest in old forest stands could utilize uneven-aged management single tree selection and small group selection harvests or various thinning methods. Management activities would be expected to move the landscape towards the desired conditions for the percent of the upland forest potential vegetation group in the OFSS and OFMS structural stages.

Alternative D would contain a guideline that would prohibit new road and trail construction in old forest.

#### *Design Elements Specific to Alternatives E and F*

Alternatives E and F would not include a specific land management area allocation for old forest. Alternatives E and F would manage old forest where it exists on the landscape. Many old forest stands that do not currently meet the definition of old forest (as defined in the Forest Service Region 6 Interim Old Growth Definition green-book) would become old forest over time. Some old forest stands would be affected by disturbances and would no longer meet the definition of old forest or provide old forest habitat requirements. The management direction in this alternative would contain flexibility that would allow forest stands to be managed for their structural stage regardless of their management allocation.

Old forest would not be included in lands suitable for timber production and would not contribute to the allowable sale quantity. Because of a deficit of old forest structure within the Blue Mountains and viability concerns for species that depend on that resource, even-aged management regeneration harvests would not be scheduled within current old forest stands. Under alternatives E and F, timber harvest in old forest stands could utilize uneven-aged management single-tree selection and small group selection harvests or various thinning methods. These alternatives would contain a guideline that would prohibit new road and trail construction in old forest.

### Management of Individual Large Diameter and/or Old Trees

In addition to the guidance pertaining to the management of old forest stands, the alternatives would differ in their management direction regarding individual large diameter and/or old trees. While this is discussed in the old forest section, the guidance pertaining to the management of individual large diameter and/or old trees would not be limited to old forest stands, but would apply both within and outside of old forest stands under all of the alternatives. The desired conditions, objectives, and standards and guidelines are discussed in detail in appendix A.

#### *Alternative A*

Alternative A would continue to follow direction from Eastside Screens. Where late and old structure falls below the HRV, the following guideline would apply: maintain all remnant late and old structure and/or structural live trees greater than 21 inches d.b.h. that currently exist within stands proposed for harvest activities. If the single-story late and old structure stage is within or exceeds HRV within a watershed, or if both late and old structure single and multi-story are within or exceed HRV, then harvest can occur within these structural stages as long as late and old structure conditions do not fall below HRV.

#### *Alternative B*

Alternative B would include a guideline related to the management of individual large diameter trees. This guideline includes the retention of live trees 21 inches d.b.h. and greater, with exceptions that allow the removal of trees 21 inches d.b.h. and greater under specific circumstances to achieve other desired conditions, such as species composition or special habitats, or due to safety concerns.

### *Alternative C*

Alternative C would include a standard that would prohibit harvesting live trees 21 inches d.b.h. and greater (no exceptions). This standard would be applied to areas outside of designated old forest management areas that grew into an old forest structural stage during the life of the plan.

### *Alternative D*

Alternative D would not include a standard or guideline that would specifically address the management of individual large diameter and/or old trees. However, only minimal harvest of trees greater than 21 inches d.b.h. would be expected to occur under alternative D because of a deficit of old forest structure within the Blue Mountains and viability concerns for species that depend on that resource. This alternative would allow for more site-specific flexibility both within and outside of old forest stands to achieve other desired conditions for forested vegetation, for example, species composition.

### *Alternative E*

Rather than using a guideline based on diameter, alternative E would contain a guideline that emphasizes retaining live trees with certain old tree characteristics. Using physical tree characteristics to infer old age would be an easier approach to managing individual old trees, would ease project implementation, and would be less expensive and time-consuming, in comparison to an alternative that utilized a more strict age guideline. For most tree species, certain tree characteristics can be used as a fairly reliable indicator of older age (generally greater than 150 years old, but varies by species and site). Van Pelt (2008) describes these characteristics in terms of the appearance of bark, branches, knots, and tree crown. Under alternative E, a guideline would be applied to areas both within and outside of old forest stands specifying that management activities should generally emphasize retaining live trees with certain old tree characteristics. For most species, old trees are generally considered to be greater than 150 years in age and may exhibit certain old tree characteristics. However, these old tree characteristics and old age may vary by species and site and should be further developed on a project-specific basis.

### *Alternative F*

Rather than using a guideline based on diameter, alternative F would contain a guideline based on age. An age-based guideline could result in increased difficulty during project implementation. Determining tree age can be a time-consuming task that involves coring individual trees with an increment borer. This process could make project implementation labor-intensive and expensive if a cut unit contained an abundance of trees that are larger in diameter and/or appear to be in the general age range of 150 years old.

Under this alternative, management activities both within and outside of old forest stands should retain live old trees greater than 150 years old, except in lodgepole pine cover types (retain trees greater than 120 years old).

## Environmental Consequences – Old Forest

Projections of future effects are uncertain because they are influenced by a complex interaction of factors, such as climate change, fire, insects, and diseases. Using past events as a basis for constructing models of future projections may cause additional uncertainty. The past is not always a good predictor of what will happen in the future, which is why the effects of management activities would be monitored.

**Key Indicator:** Acres of old forest within management area allocations with limited management activity

Table 95 displays the acres of old forest within management areas where limited management activity would occur. Under alternative C, a substantial number of additional acres would be allocated to MA 4C Old Forest Management Areas in areas that would otherwise be allocated to MA 4A General Forest. As forest stands change over time, some acres in MA 4C would no longer be old forest, while other acres outside of MA 4C would become old forest. Under alternative C, old forest stands would be considered unsuitable for timber production and timber harvest. No commercial harvest would occur within these old forest management areas, but prescribed fire and harvesting of smaller diameter trees would be allowed. Treatments within MA 4C would consist mostly of thinning trees less than 8 inches d.b.h. Alternative C would also contain the greatest number of acres of preliminary administratively recommended wilderness areas. As a result of these management area allocations, alternative C would result in the highest number of acres of old forest located within land allocations with limited management activity, in comparison to the other alternatives.

**Table 95. Acres of existing old forest within wilderness areas, old forest management areas, and backcountry areas for each alternative for each national forest**

| National Forest | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| MAL | 78,000 | 81,000 | 350,000 | 73,000 | 85,000 | 85,000 |
| UMA | 142,000 | 188,000 | 322,000 | 176,000 | 191,000 | 191,000 |
| WAW | 144,000 | 152,000 | 290,000 | 143,000 | 153,000 | 153,000 |

Alternatives B, D, E, and F would not include a specific land management area allocation for old forest. These alternatives would manage old forest where it exists on the landscape. Many old forest stands that do not currently meet the definition of old forest (as defined in the Forest Service Region 6 Interim Old Growth Definition green-book) would become old forest over time. Some old forest stands would be affected by disturbances and would no longer meet the definition of old forest or provide old forest habitat requirements. The management direction in these alternatives would contain flexibility that would allow forest stands to be managed for their structural stage regardless of their management allocation.

Alternatives A and D would have the lowest number of acres in wilderness areas, backcountry areas, and old forest management areas, resulting in the fewest acres of old forest in areas with little or no timber harvest.

**Key Indicator:** Acres of vegetation treatments within old forest

Table 96 displays the estimated annual levels of timber harvest within old forest by alternative within each national forest. The majority of timber harvest activities (approximately 60 to 90 percent) would occur within the dry upland forest potential vegetation group. The intent of all vegetation treatments within old forest (harvest, precommercial thinning, and prescribed fire), regardless of the alternative, would be to sustain and increase the amount of old forest structure, improve tree species composition, reduce stand density, and reduce the probability of severe levels of wildfire or insect related mortality outside of the desired condition. All of the alternatives provide management direction that would emphasize retaining current amounts of old forest and increasing these amounts over time. All of the alternatives contain the same desired conditions for the percent of each upland forest potential vegetation group in old forest structural stages. One of the differences between the alternatives would be the number of acres treated annually, which would influence the rate at which the desired conditions would be achieved over varying percentages of the landscape.

**Table 96. Acres of predicted timber harvest (per year) within old forest for each alternative for each national forest**

| National Forest | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| MAL | 500 | 800 | 0 | 4,800 | 1,600 | 1,000 |
| UMA | 300 | 500 | 0 | 2,900 | 1,000 | 500 |
| WAW | 200 | 300 | 0 | 2,900 | 700 | 500 |
| Total | 1,000 | 1,600 | 0 | 10,600 | 3,300 | 2,000 |

Alternative A would continue annual timber harvest within old forest at the current rate of approximately 1,000 acres per year.

Under alternative B, annual timber harvest in old forest would increase to 1,600 acres, resulting in an increase of approximately 60 percent, when compared to alternative A.

Under alternative C, timber harvest would not occur in old forest because old forest would be allocated to MA 4C Old Forest Management Areas, which would emphasize limited management. Treatments within old forest would consist mostly of thinning trees less than 8 inches d.b.h. Under alternative C, vegetation treatments within old forest would rely heavily on the use of prescribed fire (planned ignitions) and wildfire (unplanned ignitions) managed for resource benefits.

Alternative D would result in the greatest increase in timber harvest within old forest. Under alternative D, annual timber harvest in old forest would increase to 10,600 acres, resulting in an increase of approximately 960 percent, when compared to alternative A. Timber harvest under alternative D would not convert old forest to non-old forest because of a deficit of old forest structure within the Blue Mountains and viability concerns for species that depend on that resource. Even-aged management regeneration harvests would not be scheduled within current old forest stands. Under alternative D, timber harvest in old forest stands could utilize uneven-aged management single tree selection and small group selection harvests or various thinning methods. Management activities would be expected to move the landscape towards the desired conditions for the percent of the upland forest potential vegetation group in the OFSS and OFMS structural stages.

Under alternative E, annual timber harvest in old forest would increase to approximately 3,300 acres, resulting in an increase of approximately 230 percent, when compared to alternative A.

Under alternative F, annual timber harvest in old forest would increase to approximately 2,000 acres, resulting in an increase of approximately 100 percent, when compared to alternative A.

**Key Indicator:** Change in old forest structure through time

### Malheur National Forest

Table 97 displays old forest structural stages as a percent of each upland forest potential vegetation group by alternative projected over 50 years within the Malheur National Forest.

**Table 97. Old forest structural stages (percent of upland forest potential vegetation group) under each alternative within the Malheur National Forest**

| Potential Vegetation Group and Structure | DC | EC | Alt. A | | Alt. B | | Alt. C | | Alt. D | | Alt. E | | Alt. F | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Yr. 20 | Yr. 50 | Yr. 20 | Yr. 50 | Yr. 20 | Yr. 50 | Yr. 20 | Yr. 50 | Yr. 20 | Yr. 50 | Yr. 20 | Yr. 50 |
| Cold OFSS | 5-20 | 1 | 3 | 6 | 4 | 6 | 4 | 7 | 3 | 5 | 4 | 5 | 4 | 5 |
| Cold OFMS | 10-25 | 20 | 26 | 17 | 26 | 17 | 24 | 16 | 22 | 12 | 23 | 13 | 24 | 14 |
| Dry OFSS | 40-65 | 3 | 7 | 13 | 6 | 11 | 6 | 10 | 10 | 16 | 8 | 16 | 7 | 12 |
| Dry OFMS | 1-15 | 20 | 22 | 20 | 22 | 20 | 22 | 22 | 18 | 16 | 19 | 15 | 21 | 19 |
| Moist OFSS | 10-20 | 5 | 6 | 7 | 6 | 5 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Moist OFMS | 15-20 | 47 | 47 | 34 | 47 | 35 | 47 | 35 | 44 | 30 | 46 | 31 | 47 | 33 |
| All PVGs OFSS and OFMS (percent) | NA | 25 | 30 | 33 | 30 | 31 | 30 | 31 | 29 | 30 | 29 | 30 | 29 | 30 |
| All PVGs OFSS and OFMS (thousands of acres) | NA | 365 | 445 | 484 | 439 | 461 | 439 | 462 | 426 | 452 | 427 | 439 | 435 | 451 |

OFSS = old forest-single story; OFMS = old forest- multi-story; DC = desired condition; EC = existing condition; PVG=potential vegetation group

**Cold Upland Forest Potential Vegetation Group –** Within the Malheur cold upland forest potential vegetation group, all of the alternatives would result in achievement of the desired conditions for the percent of the cold upland forest potential vegetation group in the OFSS stage at year 50. The percent of the cold upland forest potential vegetation group in the OFSS stage would increase from existing conditions to year 50 under all of the alternatives. All of the alternatives would also achieve the desired conditions for the OFMS stage at year 50. The percent of the cold upland forest potential vegetation group in the OFMS stage would increase from existing conditions to year 20 under all of the alternatives, but would then decrease by year 50 due to mortality caused by wildfire and insects. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Only approximately 5 to 10 percent of the harvest activities would occur within the cold upland forest potential vegetation group. Additionally, the cold upland forest potential vegetation group in general exhibits the least amount of departure from the HRV because the historical fire regime was characterized by higher severity fire that burned infrequently; therefore this forest type has experienced the fewest number of missed fires. However, this structural stage may be difficult to maintain within the desired conditions range, especially with climate change potentially increasing the level of stand-replacing wildfire.

**Dry Upland Forest Potential Vegetation Group** – Within the Malheur dry upland forest potential vegetation group, none of the alternatives would achieve the desired conditions for the percent of the landscape in the OFSS stage by year 50 due to the large amount of variation between the existing and desired conditions and the amount of time required to develop old forest structural attributes. However, alternatives D and E would result in the greatest increase in the OFSS stage in the dry upland forest potential vegetation group at year 50, exceeding other alternatives by approximately 3 to 6 percent.

Alternatives D and E would also result in the greatest decrease in the OFMS stage in the dry upland forest at year 50, exceeding other alternatives by approximately 3 to 5 percent. This would be the result of increased timber harvest activities associated with these alternatives. Timber harvest activities would focus on the conversion of the OFMS stage to the OFSS stage by decreasing stand densities and by removing smaller size classes in the understory, while favoring larger diameter trees of more fire tolerant species. Although alternative D would not include a standard or guideline that would specifically address the management or retention of individual large diameter and/or old trees, only minimal harvest of trees greater than 21 inches d.b.h. would be expected to occur inside and outside of old forest stands under alternative D because of a deficit of old forest structure within the Blue Mountains and viability concerns for species that depend on that resource. Alternative D would allow for more site specific flexibility both within and outside of old forest stands to achieve other desired conditions for forested vegetation, for example, species composition.

Alternative E would include a guideline that would emphasize retaining live trees with certain old tree characteristics. Using physical tree characteristics to infer old age would be an easier approach to managing individual old trees, would ease project implementation, and would be less expensive and time-consuming, in comparison to an alternative that utilized a more strict age guideline. Only alternative E would achieve the desired conditions for the percent of the dry upland forest potential vegetation group in the OFMS stage at year 50. However, alternative D would only vary from the desired condition range by approximately 1 percent at year 50. Under alternatives D and E, a greater percent of the dry upland forest potential vegetation group would more closely resemble the historical open, single-story old forest structure that existed prior to interruption of the historical fire regime characterized by frequent fire. These old forest stands would be expected to be more ecologically resilient due to increased health and vigor and decreased risk of insect, disease, and fire-related mortality.

Alternative C would result in the highest percent of the dry upland forest potential vegetation group in the OFMS stage and the lowest percent in the OFSS stage at year 50. Although alternative C would contain a standard that would strictly prohibit the harvesting of all live trees 21 inches d.b.h. and greater, this standard would not result in closer achievement of the desired conditions for the percent of the dry upland forest potential vegetation group in old forest structural stages. Alternative C would result in forest structures that are more departed from the historical structures that evolved with the historical frequent fire regime. These stands would be at an increased risk of attack from bark beetles and other insects and would be more susceptible to uncharacteristically severe wildfire due to the greater amount of departure from the HRV.

**Moist Upland Forest Potential Vegetation Group** – Within the Malheur National Forest moist upland forest potential vegetation group, none of the alternatives would achieve the desired conditions for the percent of the landscape in the OFSS or OFMS stages at year 50. All of the alternatives would result in approximately 5 to 7 percent of the moist upland forest potential vegetation group in the OFSS stage.

Under all of the alternatives, the percent of the moist upland forest potential vegetation group in the OFMS stage would be lower at year 50, in comparison to existing conditions, due to mortality caused by fire, insects, and disease. Alternatives D and E would come closest to achieving the desired conditions for the percent of the moist upland forest potential vegetation group in the OFMS stage. Alternatives D and E would result in approximately 30 to 31 percent of the moist upland forest potential vegetation group in the OFMS stage at year 50.

## Umatilla National Forest

Table 98 displays old forest structural stages as a percent of each upland forest potential vegetation group by alternative projected over 50 years within the Umatilla National Forest.

**Table 98. Old forest structural stages (percent of upland forest potential vegetation group) under each alternative within the Umatilla National Forest**

| Potential Vegetation Group and Structure | DC | EC | Alt. A | | Alt. B | | Alt. C | | Alt. D | | Alt. E | | Alt. F | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Yr. 20 | Yr. 50 | Yr. 20 | Yr. 50 | Yr. 20 | Yr. 50 | Yr. 20 | Yr. 50 | Yr. 20 | Yr. 50 | Yr. 20 | Yr. 50 |
| Cold OFSS | 5-20 | 0 | 2 | 7 | 2 | 7 | 2 | 8 | 2 | 7 | 2 | 7 | 2 | 7 |
| Cold OFMS | 10-25 | 30 | 20 | 11 | 19 | 11 | 19 | 10 | 18 | 9 | 18 | 9 | 19 | 10 |
| Dry OFSS | 40-65 | 4 | 7 | 15 | 7 | 12 | 6 | 11 | 9 | 14 | 8 | 15 | 7 | 13 |
| Dry OFMS | 1-15 | 8 | 11 | 10 | 11 | 10 | 12 | 12 | 9 | 8 | 10 | 7 | 10 | 9 |
| Moist OFSS | 10-20 | 23 | 15 | 9 | 14 | 8 | 16 | 10 | 15 | 28 | 16 | 9 | 15 | 9 |
| Moist OFMS | 15-20 | 32 | 37 | 29 | 37 | 29 | 37 | 29 | 36 | 28 | 35 | 28 | 36 | 28 |
| All PVGs OFSS and OFMS (percent) | NA | 30 | 31 | 29 | 31 | 28 | 32 | 28 | 30 | 26 | 30 | 27 | 31 | 27 |
| All PVGs OFSS and OFMS (thousands of acres) | NA | 345 | 358 | 329 | 353 | 314 | 361 | 324 | 344 | 301 | 347 | 307 | 352 | 312 |

OFSS = old forest-single story; OFMS = old forest- multi-story; DC = desired condition; EC = existing condition; PVG = potential vegetation group

**Cold Upland Forest Potential Vegetation Group** – Within the Umatilla cold upland forest potential vegetation group, all of the alternatives would achieve the desired conditions for the percent of the cold upland forest potential vegetation group in the OFSS stage at year 50. All of the alternatives would also achieve the desired conditions for the percent of the cold upland forest potential vegetation group in the OFMS stage at year 20. However, the percent of the cold upland forest potential vegetation group in the OFMS stage would decrease by year 50 under all of the alternatives due to mortality caused by wildfire and insects. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Only approximately 5 to 10 percent of the harvest activities would occur within the cold upland forest potential vegetation group. This potential vegetation group, in general, exhibits the least amount of departure from the HRV because the historical fire regime was characterized by higher severity fires that burned infrequently; therefore this forest type has experienced the fewest number of missed fires. However, this structural stage may be difficult to maintain within the desired condition range, especially with climate change potentially increasing the level of stand-replacing wildfire.

**Dry Upland Forest Potential Vegetation Group** – Within the Umatilla dry upland forest potential vegetation group, none of the alternatives would achieve the desired conditions for the percent of the landscape in the OFSS stage by year 50 due to the large amount of variation between existing and desired conditions and the amount of time required to develop old forest structural attributes. However, alternatives A, D, and E would result in the greatest increase in the OFSS stage in the dry upland forest potential vegetation group at year 50, exceeding other alternatives by approximately 1 to 4 percent. Under alternatives D and E, timber harvest activities in old forest would focus on the conversion of the OFMS stage to the OFSS stage by decreasing stand densities and by removing smaller size classes in the understory, while favoring larger diameter trees of more fire tolerant species.

Although alternative D would not include a standard or guideline that would specifically address the management or retention of individual large diameter and/or old trees, only minimal harvest of trees 21 inches d.b.h. and greater would be expected to occur inside and outside of old forest stands because of a deficit of old forest structure within the Blue Mountains and viability concerns for species that depend on that resource. Alternative D would allow for more site specific flexibility both within and outside of old forest stands to achieve other desired conditions for forested vegetation, for example, species composition.

Alternative E would include a guideline that would emphasize retaining live trees with certain old tree characteristics. Using physical tree characteristics to infer old age would be an easier approach to managing individual old trees, would ease project implementation, and would be less expensive and time-consuming in comparison to an alternative that utilized a more strict age guideline.

Under all of the alternatives, the OFMS stage would remain within the desired condition range at years 20 and 50. Alternative C would result in the lowest percent of the dry upland forest potential vegetation group in the OFSS stage at year 50. Although alternative C would contain a standard that would strictly prohibit the harvesting of all live trees 21 inches d.b.h. and greater, this standard would not result in closer achievement of the desired conditions for the percent of the dry upland forest potential vegetation group in old forest structural stages. Alternative C would result in forest structures which are more departed from the structures that evolved under the historical fire regime. These stands would be at an increased risk of attack from bark beetles and other insects and would be more susceptible to uncharacteristically severe wildfire due to the greater amount of departure from the HRV.

**Moist Upland Forest Potential Vegetation Group** – Within the Umatilla moist upland forest potential vegetation group, all of the alternatives would achieve the desired conditions for the percent of the landscape in the OFSS stage at year 20. However, the percent of the moist upland forest potential vegetation group in the OFSS stage would continue to decrease under all of the alternatives, except alternative D, between years 20 and 50 due to mortality caused by insects and fire. Under alternative D, the percent of the moist upland forest potential vegetation group in the OFSS stage would increase to approximately 28 percent at year 50 and exceed the desired condition range. This would be the result of increased timber harvest activities associated with this alternative, which would result in decreased stand densities, increased tree health and vigor, decreased fire hazard, and decreased insect-related mortality.

The alternatives would not result in a substantial difference in the percent of the moist upland forest potential vegetation group in the OFMS stage. Under all of the alternatives, the percent of the moist upland forest potential vegetation group in the OFMS stage would be lower at year 50, in comparison to existing conditions, due to mortality caused by fire, insects, and disease. However, all of the alternatives would exceed the desired condition range for the percent of the moist upland forest in the OFMS stage at year 50.

## Wallowa-Whitman National Forest

Table 99 displays old forest structural stages as a percent of each upland forest potential vegetation group by alternative projected over 50 years within the Wallowa-Whitman National Forest.

**Table 99. Wallowa-Whitman National Forest old forest structure stages (percent of landscape) for each alternative**

| Potential Vegetation Group and Structure | DC | EC | Alt. A | | Alt. B | | Alt. C | | Alt. D | | Alt. E | | Alt. F | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Yr. 20 | Yr. 50 | Yr. 20 | Yr. 50 | Yr. 20 | Yr. 50 | Yr. 20 | Yr. 50 | Yr. 20 | Yr. 50 | Yr. 20 | Yr. 50 |
| Cold OFSS | 5-20 | 1% | 3 | 5 | 3 | 5 | 3 | 5 | 3 | 5 | 3 | 5 | 3 | 5 |
| Cold OFMS | 10-25 | 34% | 27 | 20 | 28 | 20 | 27 | 20 | 27 | 20 | 27 | 20 | 27 | 20 |
| Dry OFSS | 40-65 | 1% | 4 | 9 | 4 | 8 | 4 | 7 | 6 | 11 | 5 | 11 | 4 | 9 |
| Dry OFMS | 1-15 | 14% | 13 | 11 | 13 | 11 | 14 | 12 | 11 | 8 | 11 | 8 | 13 | 9 |
| Moist OFSS | 10-20 | 1% | 4 | 6 | 3 | 5 | 4 | 6 | 3 | 5 | 5 | 7 | 4 | 6 |
| Moist OFMS | 15-20 | 25% | 23 | 17 | 23 | 17 | 23 | 17 | 22 | 15 | 21 | 16 | 22 | 17 |
| All PVGs OFSS and OFMS (percent) | NA | 32% | 23 | 22 | 23 | 21 | 23 | 21 | 22 | 20 | 23 | 21 | 23 | 21 |
| All PVGs OFSS and OFMS (thousands of acres) | NA | 444 | 322 | 303 | 321 | 291 | 322 | 294 | 310 | 287 | 319 | 296 | 319 | 295 |

OFSS = old forest-single story; OFMS = old forest- multi-story; DC = desired condition; EC = existing condition; PVG = potential vegetation group

**Cold Upland Forest Potential Vegetation Group** – Within the Wallowa-Whitman cold upland forest potential vegetation group, the alternatives would not result in a substantial difference in the percent of landscape in the OFSS or OFMS stages because very little active management would occur. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Only approximately 5 to 10 percent of the harvest activities would occur within this potential vegetation group. Additionally, the cold upland forest potential vegetation group, in general, exhibits the least amount of departure from the HRV because the historical fire regime was characterized by fires that burned infrequently; therefore, this forest type has experienced the fewest number of missed fires.

All of the alternatives would achieve the desired conditions for the percent of the cold upland forest potential vegetation group in the OFSS and OFMS stages at year 50, though the percent in the OFMS stage would decrease from existing conditions under all of the alternatives due to mortality caused by wildfire and insects. This structural stage may be difficult to maintain within the desired condition range, especially with climate change potentially increasing the level of stand-replacing wildfire.

**Dry Upland Forest Potential Vegetation Group** – Within the Wallowa-Whitman dry upland forest potential vegetation group, all of the alternatives would achieve the desired conditions for the percent of the dry upland forest potential vegetation group in the OFMS stage at years 20 and 50. None of the alternatives would achieve the desired conditions for the percent of the dry upland forest potential vegetation group in the OFSS stage by year 50 due to the large amount of variation between existing and desired conditions and the amount of time required to develop old forest structural attributes. However, alternatives D and E would result in the greatest increase in the OFSS stage in the dry upland forest potential vegetation group at year 50, exceeding other alternatives by approximately 2 to 4 percent. This would be the result of the increased levels of timber harvest activities associated with these alternatives. Timber harvest activities would focus on the conversion of the OFMS stage to the OFSS stage by decreasing stand densities and by removing smaller size classes in the understory, while favoring larger diameter trees of more fire tolerant species.

Although alternative D would not include a standard or guideline that would specifically address the management or retention of individual large diameter and/or old trees, only minimal harvest of trees 21 inches d.b.h. and greater would be expected to occur inside and outside of old forest stands because of a deficit of old forest structure within the Blue Mountains and viability concerns for species that depend on that resource. Alternative D would allow for more site-specific flexibility both within and outside of old forest stands to achieve other desired conditions for forested vegetation, for example, species composition. Alternative E would include a guideline that would emphasize retaining trees with certain old tree characteristics. Using physical tree characteristics to infer old age would be an easier approach to managing individual old trees, would ease project implementation, and would be less expensive and time-consuming, in comparison to an alternative that utilized a more strict age guideline.

Alternative C would result in the lowest percent of the dry upland forest potential vegetation group in the OFSS stage at year 50. Although alternative C would contain a standard that would strictly prohibit the harvesting of all live trees 21 inches d.b.h. and greater, this standard would not result in closer achievement of the desired conditions for old forest within this potential vegetation group. Alternative C would result in forest structures which are more departed from the historical structures that evolved with the historical frequent fire regime. These stands would be at an increased risk of attack from bark beetles and other insects and would be more susceptible to uncharacteristically severe wildfire due to the greater amount of departure from the HRV.

**Moist Upland Forest Potential Vegetation Group** – Within the Wallowa-Whitman moist upland forest potential vegetation group, none of the alternatives would achieve the desired conditions for the percent of the landscape in the OFSS stage at year 50. Alternative E would result in the greatest percent of the landscape in the OFSS stage at year 50, but would be slightly below the desired condition range. All of the alternatives would achieve the desired condition for the percent of the moist upland forest potential vegetation group in the OFMS stage at year 50. Under all of the alternatives, the percent of the moist upland forest potential vegetation group in the OFMS stage would be lower at year 50, in comparison to the existing conditions, due to mortality caused by fire, insects, and disease.

### Key Indicator Summary

Table 100 displays a summary of the key indicators for old forest by alternative within each national forest. Although old forest is described using two structural stages (OFSS and OFMS) within three different potential vegetation groups, only OFSS within the dry upland forest potential vegetation group was used in the summary of key indicators. The dry upland forest potential vegetation group is the best reflection of the differences between the alternatives because approximately 60 to 90 percent of harvesting treatments would occur within the dry upland forest potential vegetation group. Additionally, OFSS within the dry upland forest potential vegetation group tends to exhibit the greatest amount of departure from the HRV.

Historically, fires burned with relatively high frequency in the dry upland forest potential vegetation group. After over a century of fire suppression, the dry upland forest potential vegetation group has experienced a greater number of missed fires than the moist and cold upland forest potential vegetation groups. In general, old forest in the cold and moist upland forest potential vegetation groups tend to be less departed from the HRV than the dry upland forest potential vegetation group.

**Table 100. Key indicators summary for old forest for each alternative for each national forest**

| Key Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| **Malheur** | | | | | | |
| Acres of old forest within management area allocations with limited management activity | 78,000 | 81,000 | 350,000 | 73,000 | 85,000 | 85,000 |
| Acres of vegetation treatments per year in old forest | 500 | 800 | 0 | 4,800 | 1,600 | 1,000 |
| Percent old forest at year 50 (all potential vegetation groups) | 33% | 31% | 31% | 30% | 30% | 30% |
| Percent dry upland forest in OFSS stage at year 50 | 13% | 11% | 10% | 16% | 16% | 12% |
| **Umatilla** | | | | | | |
| Acres of old forest within management area allocations with limited management activity | 142,000 | 188,000 | 322,000 | 176,000 | 191,000 | 191,000 |
| Acres of vegetation treatments per year in old forest | 300 | 500 | 0 | 2,900 | 1,000 | 500 |
| Percent old forest at year 50 (all potential vegetation groups) | 29% | 28% | 28% | 26% | 27% | 27% |
| Percent dry upland forest in OFSS stage at year 50 | 15% | 12% | 11% | 14% | 15% | 13% |
| **Wallowa-Whitman** | | | | | | |
| Acres of old forest within management area allocations with limited management activity | 144,000 | 152,000 | 290,000 | 143,000 | 153,000 | 153,000 |
| Acres of vegetation treatments per year in old forest | 200 | 300 | 0 | 2,900 | 700 | 500 |
| Percent old forest at year 50 (all potential vegetation groups) | 22% | 21% | 21% | 20% | 21% | 21% |
| Percent dry upland forest in OFSS stage at year 50 | 9% | 8% | 7% | 11% | 11% | 9% |

Table 100 displays the percent of all upland forest potential vegetation groups combined in old forest structural stages (OFMS and OFSS) by alternative within each national forest. When all upland forest potential vegetation groups within a national forest are combined and old forest is analyzed at a broader scale, the differences in the percent of the landscape in old forest (OFSS and OFMS combined) would vary by approximately 1 to 3 percent between alternatives at year 50. Within the Malheur National Forest, all of the alternatives would result in approximately 30 to 33 percent of all upland forest potential vegetation groups in old forest structural stages at year 50. Within the Umatilla National Forest, all of the alternatives would result in approximately 26 to 29 percent of all upland forest potential vegetation groups in old forest structural stages at year

50. Within the Wallowa-Whitman National Forest, all of the alternatives would result in approximately 20 to 22 percent of all upland forest potential vegetation groups in old forest structural stages at year 50.

When the total land area is separated into areas that are more actively managed (timber harvest) versus those with limited management activity (wilderness and backcountry), several different trends begin to emerge. Under all of the alternatives, the actively managed areas would exhibit a positive trend through time, with an increasing percent of the landscape in old forest. For example, the percent of the dry upland forest potential vegetation group in the OFSS stage would increase at year 50, compared to the existing conditions, under all of the alternatives. Those areas with limited management activity would exhibit a negative trend through time, with a decreasing percent of the landscape in old forest (see analysis file). There are several possible reasons for these trends. The combination of existing age class distribution (even within the old forest), stand density, species composition, and mix of potential vegetation groups can influence the level of wildfire and insect related mortality. Especially in the dry upland forest potential vegetation group, those stands with the highest density, highest proportion of fir, and the oldest age are those most susceptible to wildfire and insect mortality (Campbell 1996). Those old forest stands that would have some level of prescribed fire and/or timber harvest would have a lower probability of high levels of mortality of the older trees within the stand, and consequently slightly increasing amounts of old forest through time.

Within all three national forests, alternative C would result in the greatest number of acres of old forest in management area allocations with limited or no timber harvest. While alternative C would allocate the greatest number of acres to old forest, this does not necessarily mean that alternative C would result in the greatest number of acres of actual old forest structure on the landscape. The trend data mentioned in the preceding paragraph displays a decreasing percent of the landscape in old forest for areas less actively managed. Additionally, history has shown that allocations to old forest areas with limited or no management activity has not been an effective method of increasing the percent of the landscape in old forest. Over the past 20 years, old forest allocations have been affected by disturbances, such as fire, windthrow, insects, and diseases. In some instances, acres of dedicated old forest areas where vegetation species or structural composition have changed due to disturbances are still allocated to old forest management areas. Reliance on designated old growth management areas (OGMA) has now been recognized to be ineffective to meet the needs of old growth dependent wildlife species because the concept ignores the role of historic disturbance regimes and the resulting movement of old forest across the landscape. Klenner et al. (2000) demonstrated that when natural disturbance is taken into account, the loss of old growth from designated OGMAs due to wildfire indicates that maintaining old growth solely on the limited OGMA landbase is a risk-prone strategy. Additionally, as pointed out by Simberloff (1987) and displayed in table 92, not all of the areas identified as OGMAs actually contain old growth. The majority of the areas currently designated as old growth management areas do not meet the forest plan definition of old forest or the size may be inadequate to meet habitat requirements.

The most actively managed areas under each of the alternatives would be the dry upland forest potential vegetation group, where approximately 60 to 90 percent of the timber harvest activities would occur. Table 99 displays the percent of the dry upland forest potential vegetation group in the OFSS stage by alternative within each national forest.

Alternatives D and E would result in the greatest number of acres of vegetation treatments per year in old forest for the purpose of maintaining old forest or converting OFMS to OFSS and would result in the greatest percent of the dry upland forest potential vegetation group in the OFSS stage at year 50. Within the Malheur National Forest, alternatives D and E would result in approximately 16 percent of the dry upland forest potential vegetation group in the OFSS stage at year 50. Within the Umatilla National Forest, alternatives D and E would result in approximately 14 percent and 15 percent, respectively, of the dry upland forest potential vegetation group in the OFSS stage at year 50. Within the Wallowa-Whitman National Forest, alternatives D and E would result in approximately 11 percent of the dry upland forest potential vegetation group in the OFSS stage at year 50. Under alternatives D and E, annual vegetation treatments in old forest would total approximately 10,600 acres and 3,300 acres, respectively, within all three national forests. Timber harvest under alternatives D and E would not be expected to convert old forest to non-old forest. Because of a deficit of old forest structure within the Blue Mountains and viability concerns for species that depend on that resource, even-aged regeneration harvests would not be scheduled within current old forest stands, though single tree selection and small group selection harvests could occur in old forest under alternatives D and E.

Management activities would be expected to move the landscape towards the desired conditions for the percent of the dry upland forest potential vegetation group in the OFSS stage. Under alternatives D and E, timber harvest activities within old forest would focus on the conversion of OFMS to OFSS by removing smaller size classes in the understory, while favoring more fire tolerant tree species and larger diameter trees and by decreasing stand densities. As a result, these stands would more closely resemble the historical open canopy, single-story forest structure that existed prior to interruption of the historical fire regime. A more open, single-story forest structure would result in decreased competition between trees for moisture, nutrients, and sunlight, increased tree health, growth, and vigor, increased old tree longevity, increased spatial heterogeneity, decreased crown continuity, decreased ladder fuels, decreased fuel loadings, increased wind speeds required to initiate and sustain a crown fire, decreased fire severity and decreased risk of mortality from insects, disease, and fire. Decreased stand densities could also result in increased regeneration of more shade intolerant tree species and closer achievement of the desired conditions for species composition. Shade intolerant tree species such as ponderosa pine are better adapted to a frequent fire regime, better able to withstand low severity fire, and result in a lower fire hazard. Ponderosa pine also tend to be less prone to moisture stress and better adapted to drier conditions than more shade tolerant tree species. Due to more open stand densities and a more favorable species composition adapted to frequent fire, conditions would be more conducive to the reintroduction of low severity surface fire. There would be more opportunities to manage wildfire (unplanned ignitions) for resource benefits, in comparison to alternative C.

One of the disadvantages related to alternative D would be the lack of prescribed fire (planned ignitions) associated with this alternative. Alternative D would not include prescribed burning outside of harvest units and would include very limited amounts of prescribed burning within harvest units. The majority of fuels treatments within harvest units would be accomplished by removal or crushing instead of burning. The lack of fire under alternative D could inhibit other ecological processes such as nutrient cycling, resulting in decreased understory productivity, diversity, and seedling establishment.

Fire is essential to nutrient cycling in fire adapted ecosystems. Fire has a fertilizer effect on the soil by increasing ammonium levels and microbial nitrogen mineralization, resulting in increased nutrient levels in both understory and overstory vegetation. Fire rejuvenates desirable grasses, depending on the species response to disturbance (i.e., sprouters, prolific seeders, and species with strong rhizome extension respond favorably to fire). Especially when combined with reduced stand densities, fire results in changes in the microclimate on the forest floor, specifically increased sunlight penetration, increased soil temperatures, and increased understory productivity. Fire has been shown to result in significant increases in herbaceous biomass, species richness, and understory productivity and diversity. Depending on timing, fire may also increase seedling establishment by aiding in seedbed and site preparation. Fire can also aid in the creation of openings for regeneration.

Alternative C would result in the lowest percent of the dry upland forest potential vegetation group in the OFSS stage at year 50 within each national forest. Alternative C would allocate old forest to a land management area resulting in minimal amounts of active management within old forest. Treatments within old forest would consist mostly of thinning trees less than 8 inches d.b.h. While these treatments may help to reduce stand densities and ladder fuels in some stands, it would be difficult to achieve the desired conditions for stand densities in the majority of old forest stands. Additionally, it would be difficult to achieve other desired conditions, such as species composition, with so few acres treated annually and with such limitations on thinning and harvesting treatments.

Under alternative C, the decreased levels of timber harvest would result in increased stand densities within old forest stands. Increased stand densities would result in increased crown continuity, increased fuel loading, decreased wind speeds required to initiate and sustain a crown fire, and increased fire severity. Increased stand densities would also result in decreased regeneration of shade intolerant/fire tolerant tree species. Additionally, increased stand densities would result in increased competition between trees for moisture, nutrients, and sunlight, and decreased tree health, growth, and vigor.

Under alternative C, vegetation treatments within old forest would rely heavily on the use of prescribed fire (planned ignitions) and wildfire (unplanned ignitions) managed for resource benefits to reduce stand densities, rather than harvesting trees. Relying solely on the effects of fire in highly departed landscapes could result in substantially higher levels of mortality across all tree age and size classes, including the large and/or old tree component, depending upon burning conditions. Due to the high percent of the dry upland forest potential vegetation group in closed stand densities and the potential for very high levels of mortality, the window or time frame under which fire could and would be managed to achieve the desired conditions for old forest would be limited and unrealistic based on current conditions and the inability to reintroduce low severity fire effects.

While the intent of prescribed fire and wildfire managed for resource benefits under alternative C would be to improve forest structure, stand density, and species composition in old forest, the effects of fire are much less predictable than those of harvesting. High levels of mortality in the larger diameter classes would result in difficulty achieving desired conditions for old forest structure. Improvements in old forest structure, function, composition, and resiliency would likely be limited, especially within the dry upland forest potential vegetation group where vegetation conditions tend to be more highly departed from the HRV and the likelihood of reintroducing low severity fire effects in high density stands would be low. Additionally, the levels of smoke emissions generated under alternative C would be substantially increased, further limiting burn windows and the amount of acres that could be burned due to the increased levels of particulate matter generated. Impacts to public health from the likelihood of exceeding air quality standards would also substantially limit the amount of acres that could be burned under alternative C.

Alternative C would likely result in increased fire severity, decreased ecological resiliency, and loss of key ecosystem components and functions due to scope and scale of fire severity outside that which historically occurred in old forest stands within the dry upland forest potential vegetation group.

## Cumulative Effects

Potential cumulative effects were analyzed by considering the effects of the alternatives in the context of past, present (ongoing), and reasonably foreseeable future activities that have occurred within the cumulative effects analysis area. This analysis area consists of the 25 sub basins (HUC 4) which contain the Malheur, Umatilla, and Wallowa-Whitman National Forests and other lands. The time period into the future considered was 50 years. The effects that past activities have had on old forest are discussed in the Affected Environment section of this chapter and also in the Forested Vegetation, Timber Resources, and Wildland Fire Section. The effects of past activities are reflected in the old forest existing conditions. The cumulative effects for old forest are also discussed in the Forested Vegetation, Timber Resources, and Wildland Fire and Terrestrial Wildlife Species Diversity and Viability sections of this document. Present and foreseeable future activities that could affect old forest are summarized below:

### *Timber Product Manufacturing Infrastructure and Economics*

The ability of the Forest Service to positively manage forest vegetation is partially dependent upon the ability to sell forest products to manufacturing companies and to use the harvesting processes, including residual slash disposal activities. If the forest products industry continues to decline in areas surrounding the Blue Mountains to the extent that it is more difficult to sell forest products, or if “stumpage prices” decrease significantly, it would affect the number of acres that could be treated during the planning period.

Under all of the alternatives, the desired conditions would be to manage for a certain percent of each upland forest potential vegetation group in old forest structural stages (15 to 45 percent of the cold upland forest potential vegetation group; 41 to 80 percent of the dry upland forest potential vegetation group; and 25 to 40 percent of the moist upland forest potential vegetation group). Under alternatives A, B, C, E, and F, old forest stands would be considered unsuitable for timber production. Old forest takes a long time to develop, with 150 years being the minimum age requirement for old forest in most forest types. Desired conditions that manage for a higher percent of the landscape in old forest would result in a long-term commitment that would subtract from the suitable land base and result in decreased timber production during the planning period. Consequently, alternatives A, B, C, E, and F would result in lower allowable sale quantities and long-term sustained yields. Under alternative D, old forest would be considered suitable for timber production. As a result, the allowable sale quantity and LTSY would be higher, in comparison to the other alternatives, due to an increase in the number of acres suitable for timber production.

### *Carbon Sequestration*

The effects of the alternatives on carbon sequestration in general are discussed in the Forested Vegetation, Timber Resources, and Wildland Fire section. Mitigation options that can help reduce climate change impacts on carbon include: maximizing the forests’ capacity to store carbon, decreasing carbon loss potential from disturbance, and utilizing biomass for energy. However, these options need to weigh tradeoffs and risks and must ultimately be coupled with adaptation strategies. A forests’ carbon capacity could be maximized by retaining large diameter trees or by extending rotation age. Carbon loss potential from disturbance could be decreased through fuels reduction treatments that decrease fire hazard and increase ecological resiliency. Research by Hurteau and North (2009) found that, in wildfire-prone forests, tree-based carbon stocks were best protected by fuel treatments that produced a low-density stand structure dominated by large, fire-resistant pines. However, other findings suggest that reducing the fraction by which carbon is lost in a wildfire requires the removal of a much greater amount of carbon, since most of the carbon stored in forest biomass remains unconsumed even by high-severity wildfires (Mitchell et al. 2009). Most of the treatments simulated resulted in a reduced mean stand carbon storage.

Within the dry upland forest potential vegetation group in all three national forests, where approximately 60 to 90 percent of the harvesting treatments would occur, alternatives D and E would result in the greatest increase in the percent of the potential vegetation group in the OFSS stage and the greatest decrease in the OFMS stage. These alternatives would improve ecological resiliency by creating/maintaining a forest structure within old forest stands that more closely resembles the historical open, single-story forest structure that existed prior to interruption of the historical frequent, low severity fire regime. In comparison with the other alternatives, alternatives D and E would be expected to result in old stands that are more resilient in the face of climate change. Old forest stands would be expected to exhibit a decreased risk of damage or destruction by fire or insects. However, alternatives D and E would also harvest the greatest amount of timber volume and therefore remove a substantial amount of carbon.

### *Climate Change*

The effects of climate change on forested vegetation in general are discussed in the Forested Vegetation, Timber Resources, and Wildland Fire section. Of all of the ongoing and foreseeable future actions that have the potential to affect old forest within the Blue Mountains, climate change potentially may be one of the most important factors. Climate change may impact the composition, structure and function of old forest, primarily through increased temperatures, reduced snowpacks, earlier timing of snowmelt, increased risk from uncharacteristic wildfire and insect disturbance, increased drought stress, and increased risk of blowdown from extreme weather events. The increased noncatastrophic tree mortality rates in unmanaged old forests in the Pacific Northwest in recent decades have been attributed primarily to increased temperatures. Warming is thought to contribute to increasing mortality rates in old forests by increasing water drought stress on trees and enhancing the growth and reproduction of forest insects and pathogens (van Mantgem et al. 2009). As climate changes and overall forest fragmentation increases, old forests may become increasingly important as refugia for forest species.

Although increases in temperature, changes in precipitation, higher atmospheric concentrations of carbon dioxide ($CO_2$), and higher nitrogen (N) deposition may change ecosystem structure and function by the end of the 21st century, the most rapidly visible and most significant short-term effects on forest ecosystems may be caused by altered disturbance regimes (Vose et al.2012). Inadequate water availability coupled with drying conditions could contribute to an overall increase in the vulnerability of old forest to fire, insects, and drought. Recent forest dieback in the western United States and model simulations indicates that the frequency and magnitude of some disturbance events (e.g., drought, wildfire, and insect outbreaks) may be changing (Allen et al. 2010).

The relative influence of climate and fuels on fire behavior and effects varies regionally and subregionally across the western United States (McKenzie 2004). However, an increase in fire activity is expected for all major forest types in the Blue Mountains under projected climate changes (Bachelet et al. 2001, Whitlock et al. 2003, and Keeton et al. 2007). A warmer climate has already led to more frequent fires, more severe fires, earlier initiation of the fire season, and a longer fire season in the western United States (Westerling et al. 2006). Littel et al. (2009) built statistical models of the associations between seasonal and annual precipitation and temperature and fire extent for 1916 to 2002 for the 11 contiguous western states. They found that relatively modest changes in mean climate will lead to substantial increases in area burned, particularly in crown-fire ecosystems in which distinct thresholds of fuel moisture and fire weather exist (Littel 2009). For a mean temperature increase of 4° F (expected by the mid-21st century), annual area burned by wildfire is expected to increase by a factor of 1.5 to 5.

Insect life-cycles depend on a complex interaction of temperature, moisture, and suitable hosts. Although outbreak dynamics differ from species to species and from forest to forest, climate change appears to be one driving factor for some of the current forest insect outbreaks in western North America. Temperature influences everything in an insect's life, from the number of eggs laid by a single female, to the insects' ability to disperse to new hosts, to individuals' over-winter survival and developmental timing. Elevated temperatures associated with climate change, particularly when there are consecutive warm years, can speed up reproductive cycles and reduce cold-induced insect mortality. Additionally, shifts in precipitation patterns and associated drought can also influence insect outbreak dynamics by weakening trees and making them more susceptible to attacks. For many forest insect species (primarily beetles; notably *Ips* and *Dendroctonus* species), the influence of elevated temperatures on outbreak dynamics is most notable at higher elevations and latitudes where some beetles have shifted to completing their development in a single year, rather than two or even three years. In some cases, shifts have resulted in multiple generations per year. All else remaining constant, this decrease in generation time translates to an increasing rate of population growth.

Depending on the magnitude of the temperature increase, which may vary by elevation, high elevation forests could be at greater risk than lower elevation forests where warmer temperatures may disrupt the insects' seasonality. Elevated winter temperatures are associated with increased winter survival; however, it should be noted that increased winter survival does not always coincide with increased population success based on developmental timing. Each process is affected by temperature patterns occurring at different times of the year.

Under all of the alternatives, the percent of the cold upland forest potential vegetation group in the OFMS structural stage would be projected to decrease from existing conditions to year 50 within all three national forests due to mortality caused by wildfire and insects. This structural stage may be increasingly difficult to maintain within the desired condition range, regardless of the alternative, especially with climate change potentially causing further increases in the levels of stand-replacing wildfire. If temperatures increase over the next 50 years, fires may increase in size and severity, with an increase in the annual number of acres burned by wildfire. Additionally, more acres of other stand-replacing events may occur due to mortality by insects. This may result in a decrease in the percent of landscape in old forest structural stages within the cold upland forest potential vegetation group.

Within the dry upland forest potential vegetation group, alternative C would result in higher stand densities within old forest due to increased restrictions on harvesting. As temperatures increase over time, moisture may become a more limiting factor within the dry upland forest potential vegetation group. Older age classes would be most affected within a moisture-limited system because they would be less able to compete with younger, more vigorous trees. Unless stand densities are reduced within old forest stands, increased temperatures may result in increased mortality of old trees due to competitive stress.

### *Fire*

Most of the vegetation types in the analysis area have evolved with fire. Fire frequency and intensity varied historically by vegetation type. Historically, vast acres of shrub and timber burned each year (Agee 1993). There is evidence that Native Americans used fire to herd game and provide feed for stock. According to fire records, in the first half of the 20th century an average of 30 million acres burned each decade in the west (http://www.nifc.gov/fire_info.html). Before that, settlers report seeing vast acreages of blackened land (Gruell 1985). With the settlement of the west came the notion that fires were bad. Following the fires of 1910, the Forest Service began its campaign to suppress wildfires. Instead of fire, settlers employed plows, railroads, saw blades, sluice boxes, cattle, sheep, and other accoutrements as disturbance agents. Settlers converted many acres of rangelands to farm ground, primarily in the lower elevations while ranchers grazed horses, cattle and sheep on less productive and higher elevation sites. At the turn of the last century, livestock grazing occurred throughout the forest, introducing a new disturbance on what would later become National Forest System lands. High levels of livestock grazing reduced the fine fuels (grasses and shrubs) that carried low severity surface fires, resulting in a substantial reduction in fire disturbances on National Forest System lands.

Timber harvest replaced fire as the major disturbance on the national forest, but it did not affect an equivalent number of acres. This has led to a decrease in forests of older age classes and an increase, in some areas, of dense forests of smaller diameter classes. This change in age and size classes has resulted in conditions that are less resilient than desired.

Uncharacteristically severe wildfires are on the rise, especially in the dry upland forest potential vegetation group. Over the past 10 years, lightning-caused fires ranged from approximately 808 to 2,170 per year in the northwest. Human-caused fires ranged from approximately 1,078 to 2,666 fires per year in the northwest.[3] More fires are occurring adjacent to residential areas as people build more subdivisions and structures along public land boundaries. These changes are occurring across the west.

Most of the higher elevation, cold upland forest potential vegetation group within the cumulative effects analysis area consists of National Forest System lands. Therefore, any management activities affecting these vegetation types would be initiated by the Forest Service. Much of the cold upland forest potential vegetation group is located within existing or proposed wilderness, roadless, or backcountry areas. Under all of the alternatives, only approximately 5 to 10 percent of the harvest activities on Forest Service lands would occur within the cold upland forest potential vegetation groups. The majority of vegetation effects resulting from management actions within the cold forest potential vegetation group would occur as the result of wildfire managed for resource benefits. The cold upland forest potential vegetation group was historically characterized by infrequent, high severity fire. Managing wildfires for resource benefits could include a range of fire severity effects, including low severity fire to stand-replacing events with high levels of mortality. Climate change may potentially result in an increase in the size and severity of wildfires. An increase in fire size and severity could result in a decrease in the percent of the cold upland forest potential vegetation group in old forest structural stages over the next 50 years. Increased fire severity could also result in increased difficulty in managing wildfires for resource benefits to achieve desired conditions. Not every natural ignition would be managed for resource benefits. For each unplanned ignition, a decision would be made whether to suppress or manage the fire to benefit the resources in accordance with the Fire Management Plan. Under all of the alternatives, all ignitions would be managed based on safety, values at risk, and the

[3] http://www.nifc.gov/fireInfo/fireInfo_stats_lightng.html

consistency of predicted fire effects with the desired conditions. Responses can range from monitoring to full suppression.

Restoration activities occurring within the dry upland forest potential vegetation group would most likely occur in National Forest System lands. Restoration activities, such as prescribed burning or managing for old forest, would be beneficial to the overall functioning of these ecosystems and would improve wildlife habitat within these vegetation types. Some vegetation components may take many years before noticeable changes occur on the landscape. Other more localized changes would be dramatic and immediate. For example, removing large trees affects not only size class distributions of forest stands, but also the recruitment of snags over time and would reduce the density of large snags on a landscape basis. Currently, the average age structure on adjacent private forested lands is dominated by non-old forest conditions. The old forest cumulative effects analysis assumes that this would not change in the near future This would increase the importance of and dependence on old forest on National Forest System lands in sustaining the viability of wildlife species populations that depend on old forest. Given the existing deficit in old forest structure within the cumulative effects analysis area, the removal of large diameter and/or old trees on or off National Forest System lands would affect distribution of the large tree component and future snags and coarse woody debris at a landscape scale. Therefore, the retention and future development of these critical components on National Forest System lands would be essential to providing habitat elements needed by many species. Improvements to these components would cumulatively affect and improve the conditions within the dry upland forest potential vegetation group.

# Issue 5: Preliminary Administratively Recommended Additions to the National Wilderness Preservation System

## Introduction

Wilderness is a part of the national forest multiple use mandate. Historically, wilderness was instrumental in constructing America’s unique heritage and shaping its national identity. The Wilderness Act of 1964 (P.L. 88-577) emphasizes protecting an “enduring” wilderness resource “for the American people of present and future generations.” In an increasingly developed world accompanied by increased mechanization, the National Wilderness Preservation System (NWPS) was created to contrast these modifications and was established to ensure protection and preservation for wilderness areas in their natural conditions.

Section 2(c) of The Wilderness Act, “Definitions of Wilderness,” states:

> A wilderness, in contrast with those areas where man and his works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean in this Act an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

This definition highlights two subtle, but distinct concepts of wilderness (Scott 2001). The first provides an ideal concept of wilderness: areas that are untrammeled, undeveloped, and exemplify primeval character and influence without permanent improvements or human habitation. The second provides a practical definition as used for the purposes of the act and is "descriptive of the areas to which this definition applies" (Zahniser 1963). The two part definition, a conceptual ideal and a practical characterization, informs on both the act's intent and its application. Section(4)(b) of the act asserts that "Except as otherwise provided in this Act, each agency administering any area designated as wilderness shall be responsible for preserving the wilderness character of the area…" Wilderness stewardship and management has developed over the subsequent decades with an emphasis on how project or planning efforts modify wilderness character of a wilderness area. Forest Service and wilderness scholars, in describing wilderness character, selected five assessment "qualities." Landres et al. (2011) notes:

> Based on Section 2c, "Definition of Wilderness," in the 1964 Wilderness Act and building on the writing of Howard Zahniser (Zahniser 1956; Harvey 2007), wilderness scholars (Rohlf and Honnold 1988; McCloskey 1999; Scott 2002), and earlier work to describe and use wilderness character (Landres et al. 2005; Landres et al. 2008b), an interagency team published Keeping It Wild (Landres et al. 2008a), which identified five distinct and necessary "qualities" of wilderness character. These qualities were selected to be tangible, link local conditions and management directly to the statutory language of the 1964 Wilderness Act, and apply throughout the entire area of a wilderness. They apply to every wilderness regardless of size, location, agency administration, or any other attribute.

The five distinct qualities described below are used to assess wilderness character and represent a combination of attributes that both define the character of wilderness and describe wilderness characteristics (Landres et al. 2011):

**Natural:** Wilderness ecological systems are substantially free from the effects of modern civilization. This quality is degraded by many things, such as loss of indigenous species, occurrence of nonindigenous species, alteration of ecological processes such as water flow and fire regimes, effects of climate change, loss of dark skies, and occurrence of artificial sounds. It is preserved or improved, for example, by controlling or removing nonindigenous species or restoring ecological processes.

**Undeveloped:** Wilderness retains its primeval character and influence and is essentially without permanent improvement or modern human occupation. This quality is influenced by what are commonly called the "Section 4c prohibited uses," that is, the presence of modern structures, installations, habitations, and use of motor vehicles, motorized equipment, or mechanical transport. The removal of structures and not conducting these prohibited uses preserve or improve this quality. In contrast, the presence of structures and prohibited uses degrades this quality, whether by the agency for administrative purposes, by others authorized by the agency, or when there are unauthorized uses.

**Untrammeled:** Wilderness is essentially unhindered and free from the actions of modern human control or manipulation. This quality is influenced by any activity or action that controls or manipulates the components or processes of ecological systems inside the wilderness. Management actions that are not taken support or preserve the untrammeled quality, while actions that are taken degrade this quality, even when these actions are taken to protect resources, such as spraying herbicides to eradicate or control nonindigenous species or reducing fuels accumulated from decades of fire exclusion.

**Solitude or a pristine and unconfined type of recreation:** Wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation. This quality is primarily about the opportunity for people to experience wilderness, and is influenced by settings that affect this opportunity. It is preserved or improved by management actions that reduce visitor encounters and signs of modern civilization inside the wilderness. In contrast, this quality is degraded by agency-provided recreation facilities, management restrictions on visitor behavior, and actions that increase visitor encounters.

**Other Features**: In addition to these four qualities, there may be a fifth quality, called other features, based on the last clause of Section 2c in the 1964 Wilderness Act, that a wilderness 'may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.' Unlike the preceding four qualities that apply to every wilderness, this fifth quality is unique to an individual wilderness based on the features that are inside that wilderness. These features typically occur only in specific locations within a wilderness and include cultural resources, historical sites, paleontological sites, or any feature not in one of the other four qualities that has scientific, educational, scenic, or historical value.

Wilderness provides both social and biophysical benefits and values. Social benefits outlined in Section 2 (a) of the Wilderness Act state that wilderness "shall be administered for the use and enjoyment of the American people." Cole (2005) notes that wilderness experiences include recreational and social benefits described as spiritual, educational, transcendental, and symbolic. Ecological benefits include maintaining species diversity, conserving a "reservoir" of ecological processes and a diversity of genetic material, protecting threatened and endangered species, protecting watersheds, maintaining large, contiguous, nonfragmented wildlife habitats, and serving as a base line for natural conditions to compare with changes in other environments (Dawson and Hendee 2009). While these attributes may have overlapping benefits, they represent themes and values commonly attached to wilderness.

Wilderness provides social, cultural, economic, scientific, and ecological benefits for present and future generations. Many of America's iconic landscapes include wilderness areas that provide "outstanding opportunities for solitude and a primitive and unconfined type of recreation." Wilderness landscapes may also contain culturally significant and sacred sites important to Native Americans, and historic-era cultural resources that speak to the nation's collective heritage. Communities enjoy and value these lands for hunting and fishing, wildlife watching, hiking, equestrian pursuits, and other nonmotorized and nonmechanical uses. Wilderness areas are acknowledged as a scarce and dwindling resource, requiring humility on behalf of humanity in order to retain their natural condition and to convey an understanding of human and natural history. Wilderness serves as a baseline demonstrating the functions of healthy ecosystems that can be contrasted with human activities that change our world. Wilderness areas provide a variety of valuable ecosystem services including carbon sequestration, watershed protection, and air quality, and may contain habitat for numerous threatened and endangered species and other rare biological resources. Managing an area to protect its wilderness character provides unique opportunities and benefits for present and future generations that may otherwise be irreparably lost.

**Key Indicators:**

- Acres allocated to MA 1B Preliminary Administratively Recommended Wilderness Areas
- Acres of potential wilderness area allocated to other management area categories.

## Affected Environment – Preliminary Administratively Recommended Wilderness Areas

The Wilderness Act of 1964 designated roughly 9.1 million acres of wilderness distributed in 54 areas located within 13 states. Since 1964, the National Wilderness Preservation System has grown significantly. The National Wilderness Preservation System has expanded through subsequent legislation totaling 104 wilderness bills, typically establishing wilderness areas through state-wide designations. Numerous bills are pending in Congress that would create millions of acres of new wilderness areas in national forests, national parks, national wildlife refuges, and land administered by the Bureau of Land Management. Two bills identified in the 113th Congressional session would designate wilderness areas in Oregon; however none of these bills propose wilderness designation for lands administered within the Blue Mountain national forests.

The National Wilderness Preservation System includes 757 wilderness areas encompassing approximately 109 million acres, or roughly 5 percent of the total United States land mass. The Forest Service manages approximately 36 million acres in 439 wilderness areas, representing approximately 19 percent of all National Forest System land. In Oregon, there are a total of 2.5 million acres of designated wilderness equaling about 4 percent of the State land area. Oregon wildernesses represent about 2.3 percent of the area in the National Wilderness Preservation System.

The Blue Mountain national forests currently manage nearly 1 million acres of wilderness distributed across 7 designated wildernesses. The Hells Canyon Wilderness, consisting of 217,927 acres, is “nested” within the larger Hells Canyon National Recreation Area (HCNRA). The HCNRA Comprehensive Management Plan (CMP) was updated and approved in 2003 and will be carried forward in its entirety. The HCNRA CMP is the portion of the Wallowa-Whitman National Forest Land and Resource Management Plan that guides management of the HCNRA. Designated wilderness on the Blue Mountain national forest includes 759,666 acres, not including the Hells Canyon Wilderness, in six congressionally designated areas administered as wilderness. The following six wilderness areas are solely managed by the Blue Mountain national forests:

**Eagle Cap Wilderness –** This is Oregon's largest wilderness encompassing 350,461 acres in the heart of the Wallowa Mountains on the Wallowa-Whitman National Forest in Wallowa County, Oregon. Approximately 534 miles of trail give access to this area. This vast region has roughly 60 high alpine lakes, which are surrounded by open meadows, bare granite peaks and ridges, and classic U-shaped glacial valleys thickly forested in their lower sections and rising to scattered stands of alpine timber. Elevations range from roughly 5,000 feet to 9,845 feet on Matterhorn Peak located centrally within the wilderness area. Many fish species can be found in over 37 miles of streams.

**Monument Rock Wilderness –** This 19,650-acre wilderness is shared by the Malheur (12,620 acres) and Wallowa-Whitman (7,030 acres) National Forests in Baker and Grant Counties. The area ranges from 5,200 feet in the lower regions to the 7,815-foot peak of Table Rock. The visitor season generally runs from June into November. The area receives 40 inches of annual precipitation and summer brings hot days and chilly nights. Hunting is the most popular activity, with hiking and backpacking increasing in popularity.

**North Fork John Day Wilderness –** Located mostly in Grant County (Umatilla National Forest) with a small portion in Umatilla County (Wallowa-Whitman National Forest), Oregon. This 121,352-acre wilderness features rolling bench lands, the majestic Greenhorn Mountains, and the rugged gorge of the North Fork John Day River. Trails serving this area are popular for both hiking and horseback riding and are accessible from early spring to late fall from several trailheads located around its perimeter. The nature of the area provides long-distance trips with significant elevation changes. The wilderness includes four separate units. In addition to the main body of the wilderness, the Baldy Creek Unit lies to the east (on the Wallowa-Whitman National Forest), the Greenhorn Unit lies to the south (bordering the Vinegar Hill-Indian Rock Scenic Area), and the Tower Unit lies just to the north and includes Tower Mountain.

**North Fork Umatilla Wilderness –** At 20,435 acres, this is one of the smaller wilderness areas in northeast Oregon, and is located on the Umatilla National Forest in Union and Umatilla Counties. The area feels much bigger and visitors find the area peaceful, yet challenging as the wilderness is characterized by varying terrain; elevation ranges from 2,000 to 6,000 feet. Using the low elevation areas, hikers and equestrians on the 31-mile trail system have ample opportunity for spring hiking and horseback-riding trips. A main attraction is the North Fork Umatilla River.

**Strawberry Mountain Wilderness –** This 69,350-acre wilderness, located on the Malheur National Forest in Grant County, has over 100 miles of hiking trails crossing through the area dominated by the Strawberry Mountain Range. This area has extremely diverse ecological makeup; five of the seven major life zones in North America can be found here. The land is rugged; elevations range from 4,000 feet to the 9,038-foot summit of Strawberry Mountain.

**Wenaha-Tucannon Wilderness –** This 177,423-acre wilderness on the Umatilla National Forest is in Wallowa County, Oregon, and Columbia County, Washington. It contains 200 miles of managed trails providing a primitive, unconfined recreation experience. The landscape is rugged, with high basalt ridges separated by deep, steep canyons. Major streams include the Wenaha River, Tucannon River, and Crooked Creek. Elevations range from 2,000 feet at the Wenaha River to 6,400 feet at Oregon Butte.

The Wallowa-Whitman National Forest administers a portion of the Homestead Wilderness Study Area (HWSA). The HWSA, including the neighboring Federal lands managed by the Bureau of Land Management, contains about 14,000 acres of public land.

Inventoried roadless areas were reviewed, and the portion of the Homestead roadless area managed by the Wallowa-Whitman National Forest increased from approximately 5,700 acres to roughly 9,000 acres. Most of the area is within the Hells Canyon National Recreation Area, and the remainder of the roadless area is within the Whitman Ranger District. The 1991 Bureau of Land Management wilderness study process included the national forest acres and did not propose to recommend this roadless area for wilderness designation. The study has not yet been accepted by Congress, so these acres remain in the wilderness study area category. Wilderness values and resources will be protected until such time as Congress either designates the area as part of the National Wilderness Preservation System or releases the area from consideration.

There are no proposed administratively recommended wilderness areas in the 1990 forest plans for the Malheur, Umatilla, or Wallowa-Whitman National Forest.

Within the Malheur National Forest, about 5 percent or 82,000 acres are designated wilderness areas. Within the Umatilla National Forest, about 22 percent, or 304,200 acres are designated wilderness areas. Within the Wallowa-Whitman National Forest, about 24 percent, or 588,700 acres are designated wilderness areas.

## Recommendations for Wilderness Area Designation

Scoping was conducted on the Blue Mountains forest plan revision proposed action in the spring of 2010, and numerous issues and concerns were raised about the inventory of potential wilderness areas, inventoried roadless areas, and wilderness area proposals. Some respondents asked that additional wilderness area designation proposals be made to protect the values that they attach to wilderness areas. Others requested that no additional proposals for wilderness area designation be made because it would prevent them from participating in the activities that they currently enjoy within those areas. Proposals are preliminary administrative recommendations that will be further reviewed and possibly modified by the Chief of the Forest Service, Secretary of Agriculture, and the President of the United States. Congress has reserved the authority to make final decisions on wilderness area designation.

Wilderness area designation precludes the use of motorized and mechanized equipment, including motor vehicles, and imposes limitations on management activities. Wilderness areas offer human visitors solitude and opportunities for challenge, risk, and primitive and unconfined recreation. Wilderness areas are managed to ensure that human influence does not impede natural processes or interfere with natural succession in the ecosystem. Areas chosen to be preliminary administratively recommended for addition to the National Wilderness Preservation System are allocated to MA 1B under the revised forest plans. As noted previously, only Congress has the authority to make wilderness designations. MA 1B areas would be managed to maintain the quality of wilderness character that make them eligible for wilderness area designation, but they are not designated as a result of being allocated to MA 1B.

The need for additional wilderness designation in the Blue Mountain national forests was assessed in “Wilderness Need Evaluation for the Malheur, Umatilla, and Wallowa-Whitman National Forests” (USDA Forest Service 2010) and is included in the project record. The report findings, based on the above criterion, reveal that additional wilderness designation is not necessary within the Blue Mountain national forests. Protection of areas with wilderness potential including the biological species and resources that they contain may be better achieved through alternative land management designations or other legal authorities. However, it is noted that wilderness recommendations may also be made based on needs brought forward through public comment. Therefore, the decision to propose a wilderness recommendation may be made based on various land management strategies and factors, all of which include maintaining biological and natural function and diversity within and on the natural landscape.

## Environmental Consequences – Preliminary Administratively Recommended Wilderness Areas

### Resource Protection Methods

Designated wilderness is governed by the terms of the Wilderness Act and other specific legislation, directing management activities within wilderness and reducing human impacts and influences to desired levels. These regulations are designed to protect the qualities of wilderness character. As mentioned in the affected environment section, effects to wilderness are measured by how any particular project or planning effort may impact the wilderness character of a wilderness area. Project proposals within these areas are evaluated for compliance with wilderness values and maintaining the respective five qualities of wilderness character. Commercial use in wilderness is controlled by special use permits and the operation plans that are required under the special use permits.

## General Effects

Because direction for wilderness management is detailed in law, regulation, and agency policy and in specific management plans, management of existing wilderness does not vary by alternative.

The following discussion of general effects on wilderness addresses effects from adding additional recommended wilderness. Alternatives A and D do not propose any new areas for wilderness recommendation. Alternative B proposes the least number of recommended wilderness areas at 4 wilderness additions, alternative C proposes the greatest number of recommended wilderness areas at 49 wilderness additions, and alternatives E and F are similar and propose an intermediate value of 10 wilderness additions. Table 101 through table 103 display the total number of acres proposed for wilderness recommendation by alternative, and table 104 displays a summary of these totals.

Recommended wilderness can affect existing wilderness. Designation of new wilderness may change patterns of recreation use, create larger contiguous areas, and reduce pressure within existing wilderness areas. Opportunities for wilderness-dependent recreation may increase. Motorized use would be prohibited in areas recommended for wilderness designation. Motorized use (e.g. motorcycle, all-terrain vehicle, utility vehicle, and full-size vehicle use) would be displaced within recommended wilderness areas. Winter motorized use would be allowed in Management Area 1B in alternatives B, E and F, but prohibited in alternative C. Mechanized use would be restricted to system roads and trails until Congressional designation, and then mechanical use would be prohibited.

New areas considered for recommendation for wilderness designation have the potential effect of protecting wilderness resources. In addition, these areas preserve wilderness character through management efforts to maintain the five wilderness qualities (natural, untrammeled, solitude or a pristine and unconfined type of recreation, undeveloped and other features) that define wilderness character.

Only Congress can pass legislation to create wilderness, therefore, management area (MA) allocation for recommended wilderness (MA 1B) does not create designated wilderness. MA 1B, recommended wilderness, protects the values that make the area suitable for wilderness designation. Management strategies for recommended wilderness may affect recreation opportunities and experiences within these areas. Standards and Guidelines presented in the draft Plan provide management direction to maintain wilderness area eligibility, and would exclude existing and proposed actions that may compromise the area's eligibility.

**Table 101. Acres of preliminary administratively recommended wilderness areas (PARWA) for each alternative for the Malheur National Forest**

| PARWA | Alt. A | Alt. B | Alt. C | Alt. D | Alts. E and F |
|---|---|---|---|---|---|
| Aldrich Mountain | NA | NA | 4,870 | NA | NA |
| Cedar Grove | NA | NA | 5,650 | NA | NA |
| Dry Cabin | NA | NA | 12,140 | NA | NA |
| Greenhorn | NA | NA | 12,630 | NA | 6,139 |
| Jumpoff Joe | NA | NA | 2,130 | NA | NA |
| McClellan Mountain | NA | NA | 23,150 | NA | 23,145 |
| Myrtle Silvies | NA | NA | 10,930 | NA | NA |
| Shaketable | NA | NA | 7,652 | NA | NA |
| Strawberry Mountain Wilderness Area Additions | NA | 1,160 | 3,983 | NA | 1,160 |
| **Totals** | **NA** | **1,160** | **83,810** | **NA** | **30,447** |

**Table 102. Acres of preliminary administratively recommended wilderness areas (PARWA) for each alternative for the Umatilla National Forest**

| PARWA | Alt. A | Alt. B | Alt. C | Alt. D | Alts. E and F |
|---|---|---|---|---|---|
| Asotin Creek | NA | NA | 16,180 | NA | NA |
| Greenhorn Mountain | NA | NA | 11,275 | NA | 7,733 |
| Hellhole | NA | NA | 67,071 | NA | 21,980 |
| Horseshoe Ridge | NA | NA | 6,270 | NA | NA |
| Jumpoff Joe | NA | NA | 5,240 | NA | NA |
| Meadow Creek | NA | NA | 1,780 | NA | NA |
| Mount Emily | NA | NA | 5 | NA | NA |
| North Fork John Day Wilderness Area Additions | NA | 1,170 | 3,830 | NA | 1,241 |
| North Fork Umatilla Wilderness Area Additions | NA | 270 | 970 | NA | 235 |
| North Mount Emily | NA | NA | 4,616 | NA | NA |
| Owsley | NA | NA | 7,620 | NA | NA |
| Potomas | NA | NA | 6,286 | NA | NA |
| Skookum | NA | NA | 9,440 | NA | NA |
| South Fork Tower | NA | NA | 15,840 | NA | NA |
| Spangler | NA | NA | 5,710 | NA | NA |
| Squaw | NA | NA | 2,580 | NA | NA |
| Tiger Creek | NA | NA | 5,566 | NA | NA |
| Upper Tucannon | NA | NA | 13,194 | NA | 8,880 |
| W-T Three | NA | NA | 1,865 | NA | NA |
| Walla Walla River | NA | NA | 34,790 | NA | NA |
| Wenatchee Creek | NA | NA | 18,910 | NA | NA |
| Willow Springs | NA | NA | 9,490 | NA | NA |
| **Totals** | **NA** | **1,440** | **248,535** | **NA** | **40,074** |

**Table 103. Acres of preliminary administratively recommended wilderness areas for each alternative for the Wallowa-Whitman National Forest**

| PARWA | Alt. A | Alt. B | Alt. C | Alt. D | Alts. E and F |
|---|---|---|---|---|---|
| Boulder Park | NA | NA | 12,930 | NA | NA |
| Castle Ridge | NA | NA | 8,780 | NA | NA |
| Dunns Bluff | NA | NA | 760 | NA | NA |
| Homestead | NA | NA | 2,409 | NA | NA |
| Huckleberry | NA | 10,770 | 10,770 | NA | 10,770 |
| Hurricane Creek | NA | NA | 1,720 | NA | NA |
| Joseph Canyon | NA | NA | 6,750 | NA | NA |
| Lake Fork | NA | NA | 15,720 | NA | NA |
| Little Creek | NA | NA | 2,590 | NA | NA |
| Little Eagle Meadow | NA | NA | 6,840 | NA | NA |
| Little Sheep | NA | NA | 5,490 | NA | NA |
| Marble Point | NA | NA | 3,100 | NA | NA |
| Monument Rock | NA | NA | 5,850 | NA | NA |
| Reservoir | NA | NA | 15,300 | NA | NA |
| Squaw | NA | NA | 3,543 | NA | NA |
| Twin Mountain | NA | NA | 57,640 | NA | 9530 |
| Upper Catherine Creek | NA | NA | 7,020 | NA | NA |
| Wildhorse | NA | NA | 289 | NA | NA |
| **Totals** | **NA** | **10,770** | **172,749** | **NA** | **20,306** |

**Table 104. MA 1B acreage for each alternative for each national forest**

| National Forest | Alt. A | Alt. B | Alt. C | Alt. D | Alts. E and F |
|---|---|---|---|---|---|
| MAL | 0 | 1,160 | 83,810 | 0 | 30,400 |
| UMA | 0 | 1,440 | 248,676 | 0 | 40,100 |
| WAW | 0 | 10,770 | 172,840 | 0 | 20,300 |

Potential wilderness areas, primarily inventoried roadless areas, that are not allocated to MA 1B are allocated to other management area designations. Alternative D allocates the most acreage of inventoried roadless areas to management areas that allow activities that may have an impact on existing qualities of wilderness character, followed by alternative B with the second highest amount. Alternatives E and F are similar and allocate an intermediate amount of acres to management areas that allow activities that may affect existing qualities of wilderness character. Alternative C allocates the least amount of acreage to other management areas, and all potential wilderness areas in this alternative would be designated as recommended wilderness areas. Figure 11 through figure 13 and table 105 through table 107 display the total number of acres of inventoried roadless area that are allocated to varying management areas by each alternative.

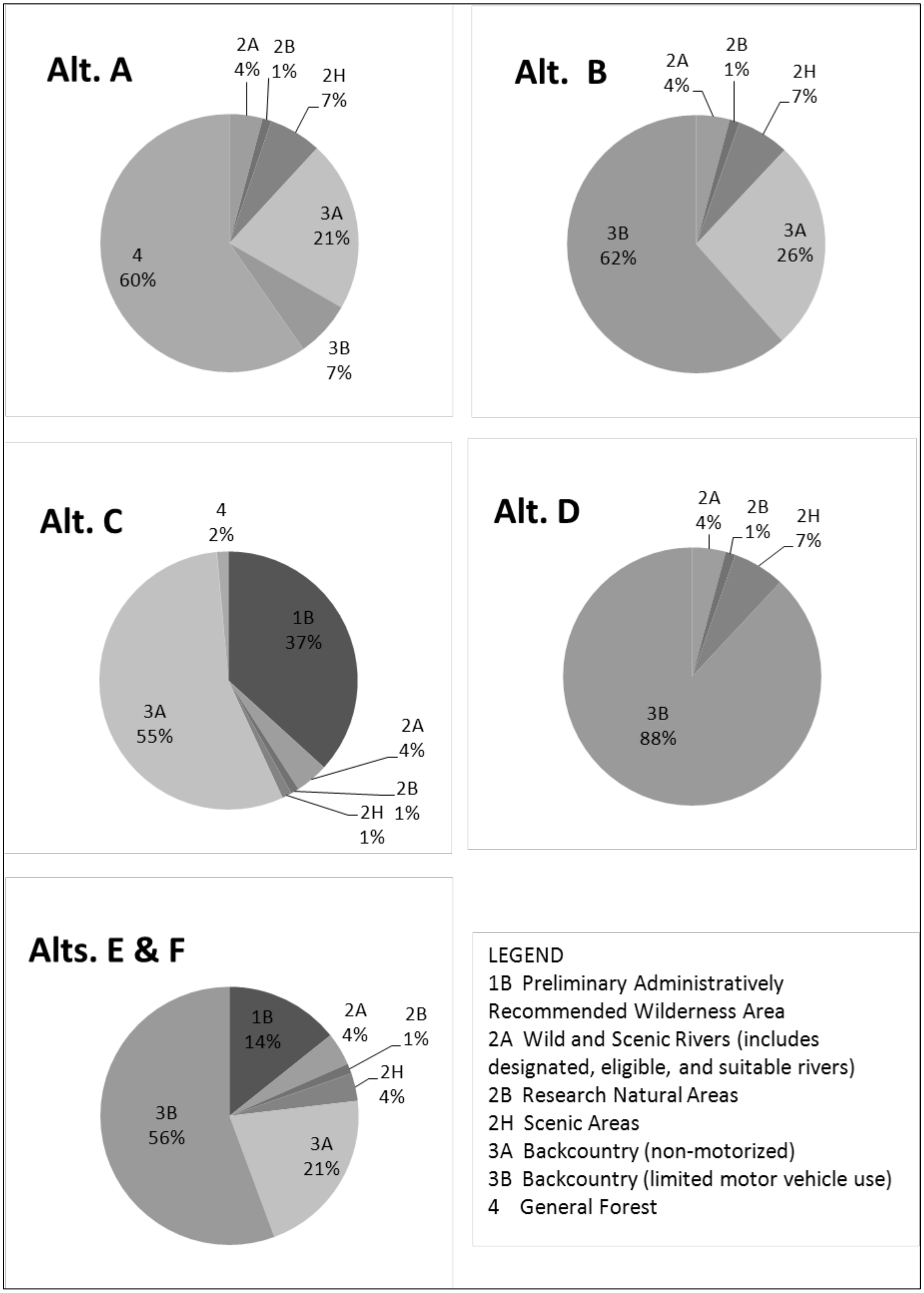


**Figure 11. Inventoried roadless area allocation for each management area by alternative for the Malheur National Forest**

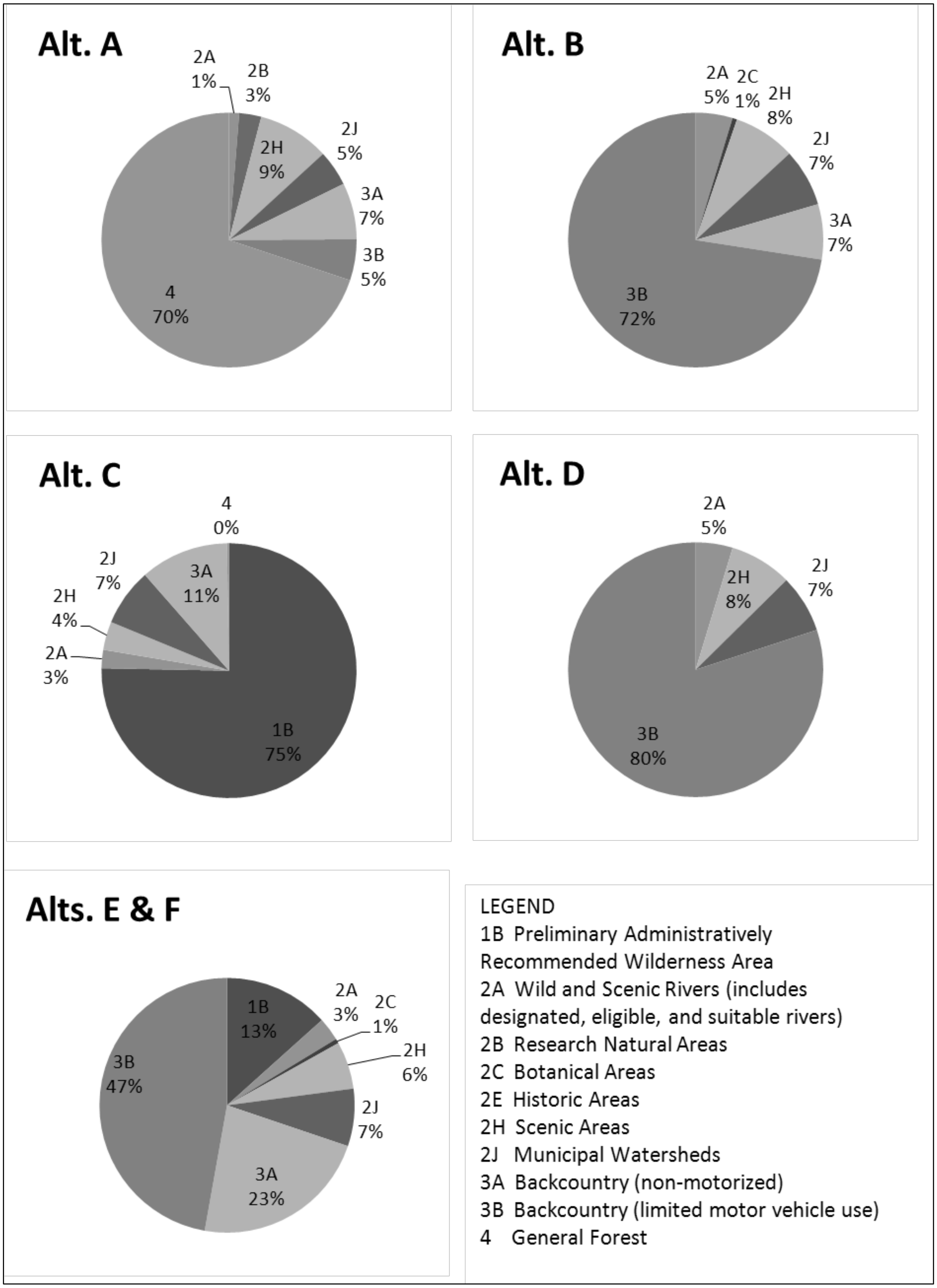


**Figure 12. Inventoried roadless area allocation for each management area by alternative for the Umatilla National Forest**

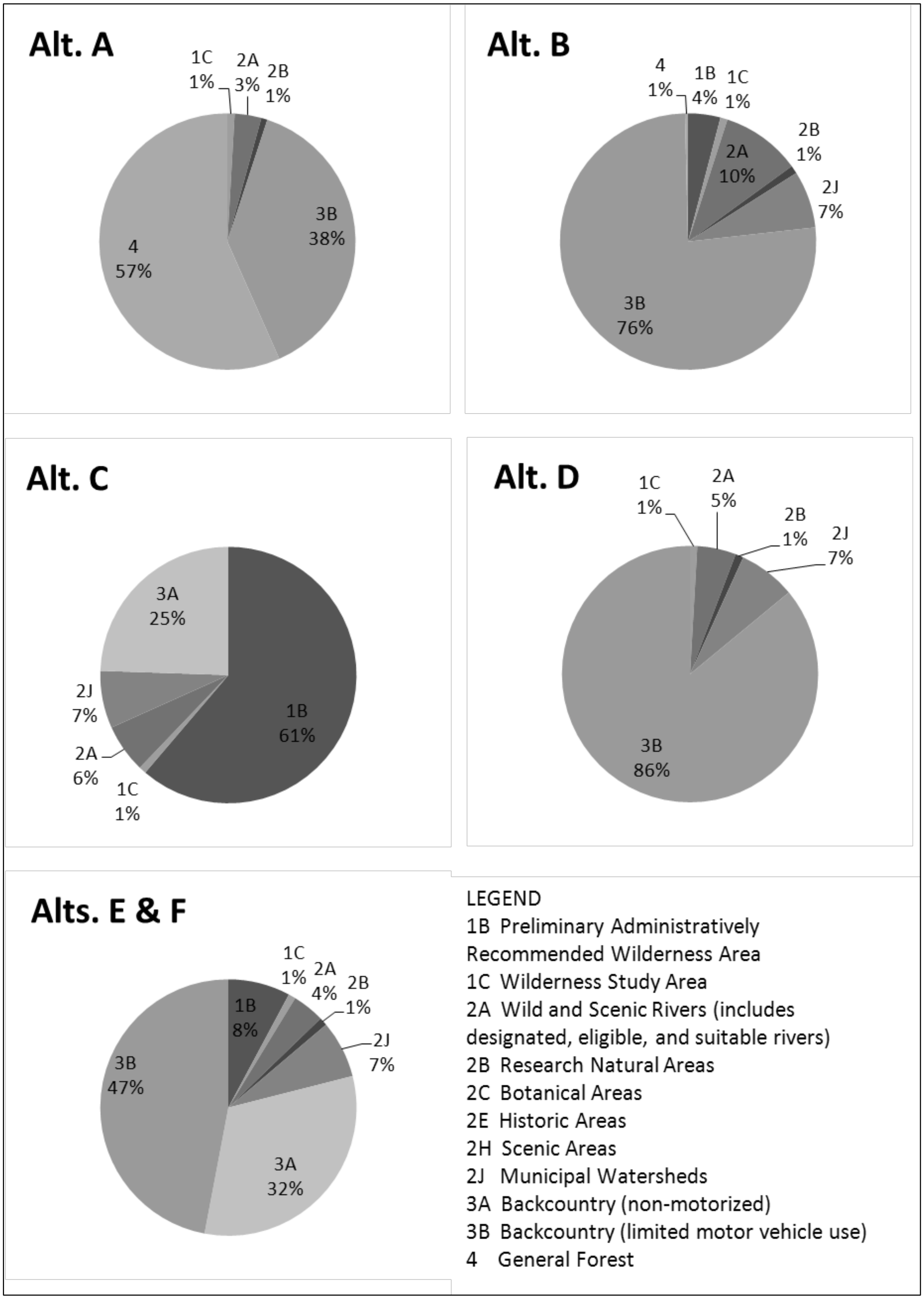


**Figure 13. Inventoried roadless area allocation for each management area by alternative for the Wallowa-Whitman National Forest**

**Table 105. Inventoried roadless area allocation for affected management areas by alternative for the Malheur National Forest**

| Management Area Designation and Name | Alt. A | Alt. B | Alt. C | Alt. D | Alts. E and F |
|---|---|---|---|---|---|
| 1B Preliminary Administratively Recommended Wilderness Area | 0 | 0 | 69,200 | 0 | 26,900 |
| 2A Wild and Scenic Rivers (includes designated, eligible, and suitable rivers) | 7,800 | 7,900 | 7,800 | 7,900 | 7,800 |
| 2B Research Natural Areas | 2,100 | 2,300 | 1,900 | 2,300 | 2,300 |
| 2C Botanical Areas | 0 | 100 | 0 | 0 | 100 |
| 2H Scenic Areas | 12,400 | 12,300 | 2,300 | 12,300 | 6,500 |
| 3A Backcountry (nonmotorized use) | 40,400 | 49,800 | 104,300 | 0 | 40,000 |
| 3B Backcountry (limited motor vehicle use) | 13,200 | 116,000 | 0 | 165,800 | 104,900 |
| 3C Wildlife Corridor | 0 | 0 | 100 | 0 | 0 |
| 4 General Forest* | 112,400 | 0 | 2,700 | 0 | 0 |
| Totals | 188,300 | 188,400 | 188,300 | 188,300 | 188,500 |

* Acreage allocated to Management Area 4 resulted from geospatial analysis and is not intended to reassign management direction from existing inventoried roadless area management direction.

**Table 106. Inventoried roadless area allocation for affected management areas by alternative for the Umatilla National Forest**

| Management Area Designation and Name | Alt. A | Alt. B | Alt. C | Alt. D | Alts. E and F |
|---|---|---|---|---|---|
| 1B Preliminary Administratively Recommended Wilderness Area | 0 | 0 | 207,100 | 0 | 36,600 |
| 2A Wild and Scenic Rivers (includes designated, eligible, and suitable rivers) | 3,500 | 12,800 | 6,400 | 12,800 | 8,100 |
| 2B Research Natural Areas | 7,700 | 300 | 0 | 300 | 300 |
| 2C Botanical Areas | 300 | 1,600 | 100 | 1,600 | 1,600 |
| 2E Historical Areas | 100 | 100 | 0 | 100 | 100 |
| 2H Scenic Areas | 25,000 | 21,600 | 9,900 | 21,600 | 16,500 |
| 2J Municipal Watersheds | 12,500 | 20,100 | 20,100 | 20,100 | 20,000 |
| 3A Backcountry (nonmotorized use) | 19,700 | 19,200 | 30,800 | 0 | 62,000 |
| 3B Backcountry (limited motor vehicle use) | 14,300 | 198,900 | 0 | 218,700 | 129,400 |
| 3C Wildlife Corridor | 0 | 0 | 100 | 0 | 0 |
| 4 General Forest* | 191,900 | 600 | 700 | 0 | 600 |
| 5 Developed Sites and Administrative Areas | 200 | 100 | 100 | 100 | 100 |
| Totals | 275,200 | 275,300 | 275,300 | 275,300 | 275,300 |

* Acreage allocated to Management Area 4 resulted from geospatial analysis and is not intended to reassign management direction from existing inventoried roadless area management direction.

**Table 107. Inventoried roadless area allocation for each management area by alternative for the Wallowa-Whitman National Forest**

| Management Area Designation and Name | Alt. A | Alt. B | Alt. C | Alt. D | Alts. E and F |
|---|---|---|---|---|---|
| 1B Preliminary Administratively Recommended Wilderness Area | 0 | 10,400 | 155,700 | 0 | 19,900 |
| 1C Wilderness Study Area | 2,300 | 2,300 | 2,300 | 2,300 | 2,300 |
| 2A Wild and Scenic Rivers (includes designated, eligible, and suitable rivers) | 8,600 | 25,600 | 15,600 | 12,500 | 10,300 |
| 2B Research Natural Areas | 2,000 | 2,600 | 300 | 2,600 | 2,600 |
| 2J Municipal Watersheds | 0 | 18,400 | 18,400 | 18,400 | 18,400 |
| 3A Backcountry (nonmotorized use) | 0 | 0 | 62,200 | 0 | 81,200 |
| 3B Backcountry (limited motor vehicle use) | 97,800 | 194,900 | 0 | 219,500 | 119,500 |
| 3C Wildlife Corridor | 0 | 0 | 400 | 0 | 0 |
| 4 General Forest* | 144,600 | 1,000 | 200 | 0 | 1,000 |
| 5 Developed Sites and Administrative Areas | 100 | 100 | 100 | 100 | 100 |
| Totals | 255,400 | 255,300 | 255,200 | 255,400 | 255,300 |

* Acreage allocated to Management Area 4 resulted from geospatial analysis and is not intended to reassign management direction from existing inventoried roadless area management direction.

## Indirect Effects

Preliminary administratively recommended additions to the National Wilderness Preservation System ensure that areas are managed to retain their wilderness character through explicit protection of the five qualities of wilderness character.

The Blue Mountain national forests provide recreational activities that range from high adventure self-reliance in the backcountry to driving scenic byways. Expansive wilderness areas provide opportunities for people to experience solitude and adventure in a natural environment. Management Area designations that are adjacent to the wilderness can potentially influence and affect wilderness character. The more acres allocated to more development-oriented management area designation, the higher likelihood of negative effects to existing wilderness. Conversely, the fewer acres allocated to more development-oriented management area designation, the lower the likelihood of negative effects to existing wilderness.

Non-wilderness uses adjacent to wilderness may have a negative effect on the quality of wilderness recreation experiences. Where roads and motorized activities occur along the wilderness boundary, the incidence of illegal use of motorized and mechanized vehicles in the wilderness may increase. High standard roads close to the boundary provide easy recreation access to wilderness and tend to increase use. As use numbers increase, particularly day use, concentrated use affects physical, biological, and social conditions in the wilderness.

Management areas bordering the wilderness that provide motorized use are more likely to affect wilderness condition and uses. The most highly developed areas (for commodity production or recreation use) are generally management areas 4 and 5. If new development occurs adjacent to any of the existing six wilderness areas, effects could include increased noise, modified landscapes, and motorized trespass.

### *Effects from Alternative A (no action)*

For this alternative, the percent of the forest allocated to National Wilderness Preservation System would remain the same, with the Malheur National Forest at 5 percent, the Umatilla National Forest at 22 percent, and the Wallowa-Whitman National Forest at 24 percent in designated wilderness areas. No new proposed administratively recommended wilderness would be allocated to MA 1B. The forest plan would not make recommendations to Congress regarding areas suitable for inclusion in the National Wilderness Preservation System (NWPS). These areas would continue to be managed as part of their current management area allocations, which vary by national forest.

Management direction in alternative A, as presented in the 1990 forest plans, places an emphasis on the production of wood products and activities allocated to MA 4. Alternative A does not propose any new recommended wilderness areas. Alternative A provides for the highest level of commodity production and motorized use. Without additional recommended wilderness, recreational use within existing wilderness may increase because acres available for wilderness recreation do not increase.

Alternative A allocates the largest amount (acres) of potential wilderness areas to MA 4A. These areas would be managed to meet a variety of ecological and human needs, resulting in an increased potential for forest visitors to encounter other people and observe human activities. This alternative offers the least protection to the five qualities of wilderness character.

#### Malheur National Forest

For the Malheur National Forest, no new areas would be allocated to MA 1B. The majority of potential wilderness areas identified on the Malheur National Forest are allocated to MA 4 – General Forest (112,400 acres) with lesser acreage allocated to MA 3A – Backcountry (nonmotorized use) (40,400 acres) and MA 3B – Backcountry (limited motor vehicle use) (13,200 acres). Lands within Management Area 4A often display high levels of management activity and associated roads. MA 3A and MA 3B are characterized by remote settings, allowing for both motor vehicle use and nonmotorized use. Although the areas are considered remote, the area may show signs of past activities. Motor vehicle access to these areas may be restricted seasonally, by route designation, or by area restrictions.

#### Umatilla National Forest

For the Umatilla National Forest, no new areas would be allocated to MA 1B. The majority of potential wilderness areas identified on the Umatilla National Forest are allocated to MA 4 – General Forest (191,900 acres) with lesser acreage allocated to MA 3A – Backcountry (nonmotorized use) (19,700 acres) and MA 3B – Backcountry (limited motor vehicle use) (14,300 acres). Lands within Management Area 4A often display high levels of management activity and associated roads. MA 3A and MA 3B are characterized by remote settings, allowing for both motor vehicle use and nonmotorized use. Although the areas are considered remote, the area may show signs of past activities. Motor vehicle access to these areas may be restricted seasonally, by route designation, or by area restrictions.

#### Wallowa-Whitman National Forest

For the Wallowa-Whitman National Forest, no new areas would be allocated to MA 1B. The majority of potential wilderness areas identified on the Wallowa-Whitman National Forest are allocated to MA 4 – General Forest (144,600 acres) with lesser acreage allocated to MA 3B – Backcountry (limited motor vehicle use) (97,800 acres). No acres are allocated to MA 3A –

Backcountry (nonmotorized use). Lands within Management Area 4A often display high levels of management activity and associated roads. MA 3B is characterized by remote settings, allowing for both motor vehicle use and nonmotorized use. Although the areas are considered remote, the area may show signs of past activities. Motor vehicle access to these areas may be restricted seasonally, by route designation, or by area restrictions.

### *Effects from Alternative B*

For this alternative, the additional acreage allocated to MA 1B would slightly increase the National Wilderness Preservation System total acres should those areas be converted to Wilderness by Congress. The percent wilderness areas and recommended wilderness areas for the Malheur National Forest would remain 5 percent. For the Umatilla National Forest, it would remain 22 percent, and for the Wallowa-Whitman National Forest, it would go up 1 percent to 25 percent. For all three forests, the additional acreage in MA 1B is situated immediately adjacent to existing designated wilderness. The additions would expand existing wilderness areas and would not create new, unique wilderness designations.

Alternative B proposes four recommended wilderness areas totaling 13,400 acres. This total is more that alternatives A and D, but less than alternatives C, E, and F. Alternative B emphasizes a combination of active management and natural processes for restoring landscapes. In this alternative, four wilderness area additions would be managed to preserve wilderness character through management efforts to maintain the five wilderness qualities (natural, untrammeled, solitude or a pristine and unconfined type of recreation, undeveloped and other features) that define wilderness character.

For this alternative, winter motor vehicle use would continue to be allowed in MA 1B.

Alternative B allocates the largest amount (acres) of potential wilderness areas to MA 3B. This area is managed generally where natural ecological processes predominate, are relatively remote, and may show signs of past activities. Use includes both motor vehicle use and nonmotorized use.

#### Malheur National Forest

For the Malheur National Forest, the Strawberry Mountain Wilderness Area Additions, comprised of three separate areas totaling 1,160 acres, would be allocated to MA 1B.

The majority of potential wilderness areas identified in the Malheur National Forest would be allocated to MA 3B – Backcountry (limited motor vehicle use) (116,000 acres) and to MA 3A – Backcountry (nonmotorized use) (49,800 acres). These management area designations are characterized by a primitive and remote setting and include areas with naturally appearing landscapes and areas that may exhibit signs of past activities. Motor vehicle access to these areas may be restricted seasonally, by route designation, or by area restrictions.

#### Umatilla National Forest Service

For the Umatilla National Forest, the North Fork Umatilla Wilderness Additions would total 270 acres and the North Fork John Day Wilderness Additions, comprised of two separate areas totaling 1,170 acres, would be allocated to MA 1B. The majority of potential wilderness areas identified in the Umatilla National Forest would be allocated to MA 3B – Backcountry (limited motor vehicle use) (198,900 acres). This management area designation is characterized by remote setting with both motor vehicle use and nonmotorized use. Motor vehicle access to these areas may be restricted seasonally, by route designation, or by area restrictions.

### Wallowa-Whitman National Forest

For the Wallowa-Whitman National Forest, the Huckleberry Roadless Area would total 10,770 acres and would be allocated to MA 1B. The area is immediately adjacent to the Eagle Cap Wilderness and would expand the existing wilderness. Large portions of the Huckleberry Roadless Area were previously added to the Eagle Cap Wilderness. The previous additions to the Eagle Cap Wilderness in 1972 and 1984 reduced the overall Huckleberry Roadless Area to less than 30 percent of its original area. This alternative would allocate the remaining acres to MA 1B.

The majority of potential wilderness areas identified in the Wallowa-Whitman National Forest are allocated to MA 3B – Backcountry (limited motor vehicle use) (194,900 acres). This management area designation is characterized by remote setting with both motor vehicle use and nonmotorized use. Motor vehicle access to these areas may be restricted seasonally, by route designation, or by area restrictions.

## *Effects from Alternative C*

For this alternative, a total of 49 new recommended wilderness areas totaling 505,000 acres would be allocated to MA 1B. This would represent an increase to the NWPS total acres should those areas be converted to Wilderness by Congress. The combined percent designated wilderness area and recommended wilderness area within the Malheur National Forest would increase 4 percent for a total of 9 percent or 165,000 acres. Within the Umatilla National Forest it would increase 17 percent for a total of 39 percent or 552,735 acres of wilderness and recommended wilderness. Within the Wallowa-Whitman National Forest it would increase 7 percent for a total of 31 percent or 761,449 acres. The additions would both expand existing designated wilderness areas and would designate new unique wilderness areas.

For this alternative, summer vehicle use would be reduced over time and winter motor vehicle use would be unsuitable in MA 1B (see the general suitability matrix table in appendix A). This change would restrict winter motor vehicle use (see the Access section for suitability changes by alternative).

Summer motor vehicle use in some locations within the Wallowa-Whitman National Forest would be affected including the Peavine, Evans, Mt Emily, Mt Fanny, Breashears, and portions of the Winom-Frazier motor vehicle trail systems. Nonmotorized use and the five qualities of wilderness character would be enhanced by these changes.

Alternative C proposes 49 new recommended wilderness areas totaling 505,000 acres. This total is more than alternatives A, B, D, E, and F. Alternative C emphasizes nonmotorized use and the role of natural process in forest restoration. This alternative would allow for the largest amount (acres) of land allocated to MA 1B. This area exhibits primitive qualities and ecosystems are influenced by natural processes with little or no human intervention. Uses are conducive to maintaining the wilderness characteristics of the area.

Alternative C would allocate the largest amount of land that contributes to enhancing the five wilderness qualities that define wilderness character when compared to the other alternatives.

### Malheur National Forest

For the Malheur National Forest a total of 9 areas totaling 83,800 acres would be allocated to MA 1B. These areas would both expand existing wilderness and would create new unique wilderness designations.

The majority of potential wilderness areas identified in the Malheur National Forest would be allocated to MA 1B and to MA 3A – Backcountry (nonmotorized use) (104,300 acres). These management area designations are characterized by primitive qualities and retain high levels of integrity regarding the five wilderness character qualities.

**Umatilla National Forest**

For the Umatilla National Forest a total of 22 areas totaling 248,500 acres would be allocated to MA 1B. These areas would both expand existing wilderness and would create new unique wilderness designations.

The majority of potential wilderness areas identified in the Umatilla National Forest would be allocated to MA 1B and to MA 3A – Backcountry (nonmotorized use) (30,800 acres). These management area designations are characterized by primitive qualities and retain high levels of integrity regarding the five wilderness character qualities.

**Wallowa-Whitman National Forest**

For the Wallowa-Whitman National Forest a total of 18 areas totaling 172,700 acres would be allocated to MA 1B. These areas would both expand existing wilderness and would create new unique wilderness designations.

The majority of potential wilderness areas identified in the Umatilla National Forest would be allocated to MA 1B and to MA 3A – Backcountry (nonmotorized use) (62,200 acres). These management area designations are characterized by primitive qualities and retain high levels of integrity regarding the five wilderness character qualities.

### *Effects from Alternative D*

For this alternative, no new areas would be allocated to MA 1B, and consequently there would not be any increase to the National Wilderness Preservation System. The percent of the forest allocated to National Wilderness Preservation System would remain the same, with the Malheur National Forest at 5 percent, the Umatilla National Forest at 22 percent, and the Wallowa-Whitman National Forest at 24 percent in designated wilderness areas. The forest plan would not make recommendations to Congress regarding areas suitable for inclusion in the National Wilderness Preservation System. These areas would continue to be managed as part of their current management area allocations, which vary by national forest.

Similar to alternative A, alternative D does not propose any new recommended wilderness areas. Alternative D proposes greater timber harvest than all other alternatives and emphasizes active management to restore the forested landscape. The alternative emphasizes retaining the areas that currently are generally suitable for motor vehicle use, resulting in more area suitable for summer and winter motor vehicle use compared to the other alternatives.

Similar to alternative B, alternative D would allocate the most acres of potential wilderness areas to MA 3B. This area is managed generally where natural ecological processes predominate, are relatively remote, and may show signs of past activities. Use includes both motor vehicle use and nonmotorized use. This alternative would contribute the least to enhancing the five wilderness qualities that define wilderness character when compared to alternatives B, C, E and F, but would enhance those qualities more when compared to alternative A.

**Malheur National Forest**

For the Malheur National Forest, no new areas would be allocated to MA 1B. The majority of potential wilderness areas identified on the Malheur National Forest would be allocated to MA 3B – Backcountry (limited motor vehicle use) (165,800 acres). This management area designation is characterized by remote settings, allowing for both motor vehicle use and nonmotorized use. Although the areas are considered remote, the area may show signs of past activities. Motor vehicle access to these areas may be restricted seasonally, by route designation, or by area restrictions.

**Umatilla National Forest**

For the Umatilla National Forest, no new areas would be allocated to MA 1B. The majority of potential wilderness areas identified on the Umatilla National Forest would be allocated to MA 3B – Backcountry (limited motor vehicle use) (218,700 acres). This management area designation is characterized by remote settings, allowing for both motor vehicle use and nonmotorized use. Although the areas are considered remote, the area may show signs of past activities. Motor vehicle access to these areas may be restricted seasonally, by route designation, or by area restrictions.

**Wallowa-Whitman National Forest**

For the Wallowa-Whitman National Forest, no new areas would be allocated to MA 1B. The majority of potential wilderness areas identified on the Wallowa-Whitman National Forest would be allocated to MA 3B – Backcountry (limited motor vehicle use) (215,500 acres). This management area designation is characterized by remote settings, allowing for both motor vehicle use and nonmotorized use. Although the areas are considered remote, the area may show signs of past activities. Motor vehicle access to these areas may be restricted seasonally, by route designation, or by area restrictions.

### *Effects from Alternatives E and F*

For these alternatives a total of 10 recommended wilderness areas totaling 90,800 acres would be allocated to MA 1B representing a moderate increase to the National Wilderness Preservation System total acres should those areas be designated to wilderness by Congress. The combined percent of designated Wilderness and preliminary administratively recommended wilderness on the Malheur National Forest would increase 1 percent for a total of 6 percent, or 113,000 acres of Wilderness and Recommended Wilderness. On the Umatilla National Forest it would increase 2 percent for a total of 24 percent or 344,274 acres of Wilderness Area and Recommended Wilderness. On the Wallowa-Whitman National Forest it would increase 1 percent for a total of 25 percent or 609,000 acres of Wilderness Area and Recommended Wilderness. The additions would both expand existing designated wilderness areas and would designate new, unique wilderness areas.

For these alternatives, winter motor vehicle use would continue to be permitted within all proposed wilderness areas except for the McClellan Mountain area within the Malheur National Forest, where it is currently prohibited.

Alternatives E and F propose 10 new recommended wilderness areas totaling 90,800 acres. This total is more that alternatives A, B and D, but less than alternatives C. Alternatives E and F emphasize the use of vegetation management and aquatic and wildlife habitat treatments to emphasize active forest restoration.

Alternatives E and F would allocate the majority of potential wilderness areas to MA 3A followed by MA 3B. The distribution is similar to alternative B for both the Malheur and Umatilla National Forests. These management area designations are characterized by a primitive and remote setting and include areas with naturally appearing landscapes and areas that may exhibit signs of past activities. Motor vehicle access to these areas may be restricted seasonally, by route designation, or by area restrictions.

This alternative would contribute more toward enhancing the five wilderness qualities that define wilderness character when compared to alternatives A, B, and D, but would contribute less when compared to alternative C.

**Malheur National Forest**

For the Malheur National Forest a total of three areas totaling 30,400 acres would be allocated to MA 1B. These areas would both expand existing wilderness and create new, unique wilderness designations if designated by Congress.

The majority of potential wilderness areas identified in the Malheur National Forest would be allocated to MA 3B – Backcountry (limited motor vehicle use) (104,900 acres) and to MA 3A – Backcountry (nonmotorized use) (40,000 acres). These management area designations are characterized by primitive qualities and retain high levels of integrity regarding the five wilderness character qualities.

**Umatilla National Forest**

For the Umatilla National Forest a total of 5 areas totaling 40,000 acres would be allocated to MA 1B. These areas would both expand existing wilderness and would create new, unique wilderness designations if designated by Congress.

The majority of potential wilderness areas identified in the Umatilla National Forest would be allocated to MA 3A – Backcountry (nonmotorized use) (62,000) and to MA 3B – Backcountry (limited motor vehicle use) (129,400 acres). These management area designations are characterized by primitive qualities and provide opportunities to protect the five qualities of wilderness character.

**Wallowa-Whitman National Forest**

For the Wallowa-Whitman National Forest a total of 2 areas totaling 20,300 acres would be allocated to MA 1B. These areas are adjacent to existing wilderness areas and would expand the existing wilderness boundaries if designated by Congress.

The majority of potential wilderness areas identified in the Wallowa-Whitman National Forest would be allocated to MA 3A – Backcountry (nonmotorized use) (81,200 acres) and to MA 3B – Backcountry (limited motor vehicle use) (119,500). These management area designations are characterized by primitive qualities and provide opportunities to protect the five qualities of wilderness character.

### *Effects Common to Alternatives B, C, E, and F*

The areas that would be allocated to MA 1B have been determined to meet the criteria established to qualify for designation as wilderness areas. These areas are preliminarily recommended for designation and inclusion in the National Wilderness Preservation System. Until a decision is made by Congress, these areas will be managed to protect the five qualities of wilderness character that meet the criteria for designation of these lands as wilderness areas.

Lands allocated to MA 1B within the action alternatives were previously managed as undeveloped lands and generally do not permit activities that conflict with conserving wilderness area character. For this reason, there would not be a large shift in management activities or access limitations for MA 1B (with the exception of alternative C in some locations, see discussion above for winter motorized use restrictions).

#### *Effects Common to Alternatives B, E, and F*

For these alternatives, over snow vehicle (OSV) use is determined suitable as displayed in the general suitability matrix in appendix A. Although long-term physical impacts of over snow vehicle use may be difficult to quantify, snowmobiles do cause short-term physical and social impacts.

Snowmobiles generate biophysical and social impacts. Physical impacts may include effects to wildlife that include increased stress, reduced survival and productivity, impaired immune function, disruption to movement patterns, and changes to behavioral adaptations (Smith 2013). Additional physical impacts include effects to vegetation, soils, and air quality impacts resulting from emissions (Newman and Sears 1999). Social impacts are marked by increased noise and by reduced visual/scenic quality. Snow machines are often audible over great distances, and tracks in snowfields and high mark play areas may be widespread and affect natural appearance and sense of solitude.

The potential effects that result from over snow vehicle use in preliminary administrative recommended wilderness areas (MA 1B) include a reduction in the area’s wilderness character and value, and consequently a reduction in the area’s eligibility for designation and inclusion in the National Wilderness Preservation System. Wilderness recommendations and designation are often controversial, and recent congressional review and findings regarding recommended wilderness areas reveal that areas with reduced wilderness character may be considered ineligible for wilderness designation.

#### *Social Needs and Expectations*

Preliminary Administratively Recommended Wilderness Areas (MA 1B) would be unsuitable for timber harvest, summer motor vehicle use (also unsuitable for winter motor vehicle use in alternative C, see discussion above), road construction, energy development, or mechanical fuels treatment. Limited management activities would be permitted for the purposes of visitor safety and prevention of resource impacts, including invasive species treatment. Grazing would be allowed as a permitted activity. Mining would be allowed to continue unless the area is withdrawn from mineral activity. Summer recreation uses that are nonmotorized, including using mechanical vehicles, such as mountain bikes, would continue.

MA 1B would provide visitors with opportunities for quiet recreation, although in some alternatives, winter motor vehicle recreation would be permitted in some areas. Wildlife disturbance would be minimal. Recreation activities in these areas would be compatible with wildlife use of the area. Wildlife disturbance or disruption from recreation during breeding/nesting periods would be minimized. Winter recreation, such as cross-country skiing and snowmobiling, would still occur in some instances and would stress wintering animals during deep snow periods. Over-the-snow trails providing access to these areas would continue to provide animals access to areas they usually could not use during the winter because of deep snow conditions (see the Terrestrial Wildlife Species Diversity and Viability section for the wildlife habitat security discussion).

The national forests in the Blue Mountains are currently and will continue to remain popular for recreation activities in areas outside wilderness. Hunting, relaxing, fishing, hiking and walking, gathering forest products, driving for pleasure, viewing wildlife, downhill skiing, and viewing natural features comprise 73 percent of recreational use. Although some of these uses may occur in wilderness areas, none is exclusive to or dependent upon wilderness areas to provide for these activities.

While the Blue Mountains provide high potential opportunities for unconfined recreation experiences and solitude, regionally and locally, the social demand for these unconfined experiences is related to general dispersed settings, not just wilderness, that provide both motorized and nonmotorized activities. From a regional perspective, the national forests of the Blue Mountains are perceived as high opportunities for cultural and spiritual values, historic significance, scenic vistas, hunting, and off-highway vehicle use.

From a forest-level perspective, the recreational users express social values for wilderness areas in numerous ways: solitude for psychological health; un-fragmented forests for habitat and intact landscapes; spiritual uses for solace of open, quiet, beautiful places; for wildlife and pristine settings; and economic opportunities for tourism, hunting, and fishing.

Social values for nonwilderness areas are expressed by recreational users for a variety of reasons: providing a balance of nonmotorized and motorized uses; allowing multiple uses including hunting, fishing, recreation, tourism; and timber harvesting to manage for forest health and to support community economics. Recreational users often express competing or conflicting social values for wilderness and nonwilderness uses for the same places (such as motorized and nonmotorized access; unmanaged and managed landscapes; expansion of recreation trails and limitations on uses). Within the Blue Mountain national forests, there remains a wide variety of opportunities for unconfined outdoor recreation experiences within both wilderness and nonwilderness national forest lands. The desired condition for MA 1B are provided in appendix A. The management area maps show the locations of MA 1B for each of the alternatives.

## Cumulative Effects

The cumulative effects for the Blue Mountain national forests would be the allocation of National Forest System lands to MA 1B Preliminary Administratively Recommended Wilderness Areas. These lands currently are allocated to other management areas. There are no cumulative effects from alternatives A and D. In alternatives B, E, and F, there would be a relatively small number of acres allocated to MA 1B, and in alternative C, the number of acres allocated to MA 1B would be greatest. Since the areas that would be allocated to MA 1B for alternatives B, C, E, and F meet the criteria established in FSH 1909.12 chapter 70, there would be no change in suitable uses for these areas, except for alternative C, which would make winter motor vehicle use unsuitable.

Areas allocated to MA 1B would increase the qualities of wilderness character. Natural quality would be increased through conserving plant and animal species and communities, physical resources, and biophysical processes. Untrammeled quality would be enhanced by reducing actions that manipulate the biophysical environment. Undeveloped quality would improve through reducing structures, installations and developments not related to recreation. The qualities of solitude or primitive and unconfined attributes would be improved by retaining remoteness and by excluding facilities that decrease self-reliance. Additional qualities including ecological, geological, or other features of scientific, educational, scenic, or historical value would be conserved. Enhancing these qualities would have a beneficial effect on wilderness characteristics and values.

As noted above, lands considered eligible for allocation to MA 1B were previously managed as undeveloped lands and generally do not permit activities that conflict with conserving wilderness area character. For this reason, there would not be a large shift in management activities or access limitations for MA 1B. In general, the areas that would not be allocated to MA 1B would be allocated to MA 3A-Backcountry (nonmotorized use), or to MA 3B-Backcountry (limited motor vehicle use). These backcountry settings would retain many of the qualities of wilderness character and would continue to conserve wilderness values.

**Effects from other Management Areas:** Adjacent management activities can have a direct effect on Wilderness and recommended wilderness areas. Gorte (2011) noted that while The Wilderness Act of 1964 does not speak to the issue of buffer zones around wilderness areas, subsequent legislation has prohibited creating buffer zones that would “restrict… uses and activities on federal lands around the wilderness area. The first explicit language was enacted in 1980 in P.L. 96-550; § 105 states:

> Congress does not intend that the designation of wilderness areas … lead to the creation of protective perimeters or buffer zones around each wilderness area. The fact that nonwilderness activities or uses can be seen or heard from areas within the wilderness shall not, of itself, preclude such activities or uses up to the boundary of the wilderness area.”

Nearly identical language has been included in 30 wilderness statutes since 1980 (*ibid*). Although subsequent wilderness statutes prohibit wilderness buffer zones, management actions conducted adjacent to wilderness boundaries can affect both management and use of the area inside the wilderness boundary. Areas adjacent to designated wilderness and recommended wilderness that are managed for nonmotorized use are usually more compatible with wilderness management objectives and maintaining wilderness character and quality.

As noted above, management areas bordering designated and recommended wilderness that provide for motorized use are more likely to affect wilderness condition and character. The most highly developed areas (for commodity production or recreation use) are generally MA 4A and MA 5. If new development occurs adjacent to any of the existing six wilderness areas or recommended wilderness areas, effects could include increased noise levels, modified landscapes, and motorized trespass.

**Effects from Timber Harvest:** The Wilderness Act provides limited timber cutting for mining relating activity, and Section (4)(d)(1) specifies that “such measure may be taken as may be necessary in the control of fire, insects, and diseases, subject to such conditions as the Secretary deems desirable.” Vegetation management in wilderness, wilderness study areas, and recommended wilderness is generally restricted to use of wildland fire for multiple objectives in all alternatives. Wildland fire would continue as a possible management technique under all alternatives. Fire suppression measures would be used if and where fuels and weather increase the risk of unwanted fire, either within or emanating from wilderness, wilderness study areas, or recommended wilderness. All alternatives provide for use of wildland fire for multiple objectives in these areas.

Timber harvest activity in areas adjacent to wilderness and recommended wilderness may affect qualities of wilderness character, specifically solitude or primitive and unconfined quality. Vegetation management actions outside of wilderness may affect the remoteness from occupied and modified areas from within the wilderness. Additionally, the wilderness character of natural quality may be impaired through altering plant and animal species and communities in areas adjacent to wilderness, and through an increased potential for the introduction of nonnative species though ground disturbing activities.

**Effects from Fire and Fuels Management:** While all human-caused fires within wilderness have a management objective of suppression, current and past agency direction allows naturally ignited fires within wilderness and recommended wilderness to be used to accomplish resource benefit objectives including restoring the role of fire in wilderness areas. The Blue Mountain national forests actively manage naturally ignited fires within wilderness to achieve resource benefit. Natural ignitions within wilderness and recommended wilderness areas may also be suppressed to meet protection objectives for values at risk outside of wilderness, or because site specific conditions are unfavorable toward meeting desired resource benefit objectives.

The trend to allow naturally ignited fires to accomplish resource benefits in wilderness and recommended wilderness is expected to continue in the future. All alternatives have desired conditions and objectives that include allowing fire to play its natural role in the wilderness ecosystem. These objectives pertain to both designated and any recommended wilderness. The importance of fire and impacts of fire suppression have long been understood, and naturally ignited fire is recognized as a crucial factor in maintaining naturalness within wilderness (D. Cole and P. Landers 1995).

Impacts resulting from fire suppression activity include possible use of mechanized equipment such as chainsaws for fireline construction, use of motorized equipment such as helicopters, and application of retardant. Minimum Impact Suppression Tactics (MIST) are used to minimize suppression impacts to the greatest extent possible while meeting the overall suppression objective.

Restoring natural fire regimes is compounded by the attendant risk to natural and cultural resources, property, and visitors, both within wilderness and on adjacent lands. Fire, in its natural role, can enhance the natural quality and character of wilderness. Wildland fire would continue as a reintroduced process in wilderness and recommended wilderness areas under all alternatives, and would have similar effects. Wildland fire for resource benefit increases the wilderness character of natural quality, but may adversely affect “solitude or primitive and unconfined quality” where visitors may encounter crews conducting fire management activities.

**Effects from Livestock Grazing:** Commercial livestock grazing is permitted in wilderness by the Wilderness Act of 1964 and in areas designated after 1964, where the activity was established prior to wilderness designation. While being an allowable use, livestock grazing presents nonconforming activities within designated wilderness (e.g. motorized access, structural and nonstructural improvements). Grazing use and management direction within wilderness was further reviewed by U.S. congressional committees in the 95$^{th}$ and 96$^{th}$ Congress (Hendee and Dawson 2009). House Report 96-617 accompanied the Colorado Wilderness Act (P.L. 96-560) providing additional interpretation and clarification regarding the intent presented within Wilderness Act relating to grazing use and activity. The report, often referred to as the “congressional grazing guidelines,” “provided for continuation of existing grazing use; the maintenance and construction of supporting facilities including ‘fences, line cabins, water wells and lines, and stock tanks;’ and the temporary use of motorized equipment to repair facilities and for emergency purposes” (*ibid*). Livestock grazing is a well-established use within national forest designated wilderness as provided for in The Wilderness Act and subsequent legislation, and is an appropriate use of wilderness and recommended wilderness areas.

Livestock grazing use in wilderness may affect the five wilderness character qualities to varying degrees. Grazing allotments within wilderness are managed to conserve the range resource while observing existing law, regulation, and policy.

Recreational livestock grazing standards and guidelines vary by national forest and are not directly regulated by a permitting process; only livestock used by commercial outfitters and guides is under permit. Standards and Guidelines included in the draft Plan provide a framework for managing recreational livestock grazing use, reducing impacts and influences to desired levels, and maintaining the five wilderness character qualities.

**Effects from Minerals Management:** The Wilderness Act of 1964 allows for mining activity within designated wilderness. The use is conditioned by specific criteria outlined within the act and by agency regulations designed to minimize affects to wilderness character. However, given these considerations, mining activity within wilderness is generally characterized as being minimal to nonexistent and prospecting for new claims within wilderness has largely ended (Hendee and Dawson 2009). These current conditions are consistent with mineral survey findings that reveal an overall lack of major mineral deposits within wilderness that are economically viable (*ibid*). Developing mineral operations within wilderness are generally more difficult and costly and may contribute to the overall absence of development (see the Mineral Resource section for leasable minerals, geothermal, coal, locatable minerals, saleable minerals and other [wind] energy discussions).

**Effects from Recreation and Access:** Section (4)(b) of The Wilderness Act states that "wilderness areas shall be devoted to the public purposes of recreational, scenic, scientific, educational, conservation, and historical use." Recreation is the most obvious and reported use of wilderness. Though recreation use is a prescribed use within wilderness, visitor and recreational use in wilderness and recommended wilderness has the potential to impair wilderness character: natural quality may be affected through impacts to physical resources (e.g. water, soil); undeveloped quality may be affected by recreation related facilities and developments; and the solitude or primitive and unconfined quality may be affected by facilities that decrease self-reliance and through management restrictions on visitor use.

Section (4)(c), Prohibition of Certain Uses, of the Wilderness Act states that "there shall be no temporary road, no use of motor vehicles, motorized equipment or motorboats, no landing of aircraft, no other form of mechanical transport, and no structure or installation within any such area." While Section (4)(c) prohibits motorized use within wilderness, use of motorized vehicles, equipment, or mechanical transport in areas adjacent to designated or recommended wilderness has the potential to impair the undeveloped quality of wilderness character. Similarly, the wilderness character of solitude or primitive and unconfined quality may be impaired by a decrease in remoteness from occupied and modified areas outside the wilderness.

# Issue 6: Ecological Resilience

This section describes the affected environment and environmental consequences related to the ecological resilience significant issue. Concern about the amount, type, and extent of management activities that would be aimed at restoring ecological resilience in the proposed action was expressed during the scoping comment period. Based on perceptions of the current vegetation condition and its resilience, some people think the management approach would be too aggressive while others expressed a desire for a more aggressive approach. The level of public concern is heightened because the management approach to restoring ecological resilience would determine what ecosystem services the Blue Mountains national forests could provide.

Forest Service policy to reestablish and retain ecological resilience (FSM 2020) was developed after the 1990 forest plans were approved. Resilience is defined as the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change (FSM 2020 interim directive). While the foundational policy for the national forests is to achieve sustainable management and provide a broad range of ecosystem services, forest plans determine the management approach by defining objectives, desired conditions, and standards and guidelines and by predicting outcomes.

## Affected Environment – Ecological Resilience

This issue influenced development of the alternatives, which include varying levels of restoration activities and resulting outcomes. The measures for this issue reflect the level of management activities designed to maintain or restore resilience and the anticipated effects on resilient conditions (as measured by the degree that alternatives are predicted to achieve the desired conditions). The alternatives that are predicted to make the most progress towards achieving the desired conditions would also be the alternatives that restore the highest level of resilience.

### Key Indicators to Reflect the Level of Management Activity

- Annual forested vegetation active restoration activities (acres)
- Roads treatments in priority watersheds (miles)
- Forage use in priority watersheds (intensity)
- Improved riparian areas (miles)

### Key Indicators to Reflect Resilient Conditions

- Watersheds in improved conditions
- Improvement in the dry upland forest potential vegetation group fire regime condition class departure score at year 50

## Environmental Consequences – Ecological Resilience

### Key Indicators to Reflect Levels of Management Activities

#### *Annual Forested Vegetation Active Restoration Activities*

The acres displayed in table 108 would be the sum of the annual forested vegetation harvest treatments, planting, and noncommercial thinning. These treatments would be designed to make progress toward achieving multiple desired conditions, such as forested structural stages, species composition, stand density, and fire regime condition class, to restore ecological resiliency. These projections are a reflection of the combination of plan components in each alternative, the assumptions used to identify treatment needs, and the existing vegetation condition.

**Table 108. Annual acres of forested vegetation harvest treatments, planting, and noncommercial thinning (with the percent change from existing levels in parentheses) under each alternative within each national forest**

| National Forest | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| MAL | 8,600 (0%) | 9,200 (7%) | 4,800 (-44%) | 25,100 (192%) | 15,300 (78%) | 10,600 (23%) |

| National Forest | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| UMA | 6,950 (0%) | 7,400 (6%) | 4,000 (-42%) | 20,100 (189%) | 13,400 (93%) | 8,700 (25%) |
| WAW | 7,150 (0%) | 7,650 (7%) | 3,950 (-45%) | 22,650 (217%) | 12,950 (81%) | 9,350 (31%) |

Under alternative A, harvest treatments, planting, and noncommercial thinning would continue at the current rates within the analysis area. Within all three national forests, alternative D would result in the greatest number of acres of harvest treatments, planting, and noncommercial thinning. Under alternative D, treatments would accelerate from current levels by approximately 189 percent to 217 percent within the analysis area. Within all three national forests, alternative E would result in the second greatest number of acres of harvest treatments, planting, and noncommercial thinning. Under alternative E, treatments would accelerate from current levels by approximately 78 percent to 93 percent within the analysis area. Alternative C would result in the least number of acres of harvest treatments, planting, and noncommercial thinning. Under alternative C, treatments would decelerate by approximately 42 percent to 45 percent within the analysis area.

Table 128 displays the estimated annual acres of fuels management activities inside and outside of harvest units. These acres include prescribed burning inside and outside of harvest units without ground-based mechanical pretreatment and prescribed burning or the removal of fuels with ground-based equipment inside of harvest units.

Under all of the alternatives, except alternative D, prescribed burning outside of harvest units would continue at the current rate of approximately 30,000 acres per year within all three national forests. Under alternative D, the use of prescribed fire (planned ignitions) outside of harvest units would be eliminated.

Under alternative D, most of the activity-generated fuels would be treated mechanically. The majority of the fuels treatments within harvest units would be accomplished by removal or crushing, instead of prescribed burning. Only approximately one-fourth of the total acres harvested annually would be prescribed burned.

Alternative E would result in the greatest number of acres of prescribed burning inside of harvest units within all three national forest. Within the Malheur National Forest, prescribed burning within harvest units would increase by approximately 76 percent from current levels. Within the Umatilla National Forest, prescribed burning within harvest units would increase only slightly from current levels. Within the Wallowa-Whitman National Forest, prescribed burning within harvest units would increase by approximately 108 percent from current levels.

Alternative C would result in the fewest number of acres of prescribed burning inside of harvest units within all three national forest. Within the Malheur National Forest, prescribed burning within harvest units would decrease by approximately 52 percent from current levels. Within the Umatilla National Forest, prescribed burning within harvest units would decrease by approximately 75 percent from current levels. Within the Wallowa-Whitman National Forest, prescribed burning within harvest units would decrease by approximately 54 percent from current levels.

**Table 109. Annual acres of fuels management activities under each alternative within each national forest**

| National Forest | Activity | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|---|
| MAL | Prescribed burning outside of harvest units* | 9,500 | 9,500 | 9,500 | 0 | 9,500 | 9,500 |
| | Prescribed burning inside of harvest units* | 5,300 | 5,300 | 2,500 | 5,100 | 9,400 | 6,200 |
| | Prescribed burning or removal of fuels with ground-based equipment inside of harvest units** | 1,800 | 1,800 | 900 | 15,400*** | 3,100 | 2,100 |
| UMA | Prescribed burning outside of harvest units* | 10,000 | 10,000 | 10,000 | 0 | 10,000 | 10,000 |
| | Prescribed burning inside of harvest units* | 7,800 | 7,800 | 1,700 | 4,000 | 7,900 | 4,800 |
| | Prescribed burning or removal of fuels with ground-based equipment inside of harvest units** | 1,300 | 1,300 | 600 | 12,000*** | 2,700 | 1,600 |
| WAW | Prescribed burning outside of harvest units* | 10,500 | 10,500 | 10,500 | 0 | 10,500 | 10,500 |
| | Prescribed burning inside of harvest units* | 3,400 | 3,450 | 1,550 | 4,300 | 7,050 | 4,550 |
| | Prescribed burning or removal of fuels with ground-based equipment inside of harvest units** | 1,100 | 1,100 | 500 | 12,700*** | 2,300 | 1,500 |

* Without ground-based mechanical pretreatment. **Could include treatment of fuels with ground-based equipment.
*** Would include mostly removal of fuels with ground-based equipment.

Table 110 displays the annual acres of forested vegetation active restoration activities and the percent of management area 4A (general forest) that would be treated annually under each of the alternatives by national forest. For alternatives A and C, the percent treated annually also included the acres of management area 4C (old forest). MA 4A and 4C were used in the example because the majority of the active restoration activities would occur within these management areas. Under alternatives B, D, E, and F, acres of old forest would be included within general forest. Active restoration activities include harvest treatments, planting, non-commercial thinning, and prescribed burning outside of harvest units. Acres of prescribed burning within harvest units was not included in table 117 because those acres were already included in the harvest treatment acres. The alternative that contains the greatest number of total acres of MA 4A (general forest) (and 4C old forest under alternatives A and C) would have the potential to result in the largest percent of the landscape restored over the long-term, thereby resulting in increased ecological resilience.

**Table 110. Estimated annual acres of forested vegetation active restoration activities* and the approximate percent of management area 4A treated annually under each alternative by national forest**

| National Forest | Restoration Activities | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|---|
| MAL | Annual acres of forested vegetation active restoration activities* | 18,100 | 18,700 | 14,300 | 25,100 | 24,800 | 20,100 |
| | Total acres of MA 4A and 4C | 882,253 | 1,252,000 | 907,600 | 1,359,800 | 1,245,600 | 1,245,600 |
| | Percent of MA 4A and 4C treated annually | 2 | 1 | 2 | 2 | 2 | 2 |
| UMA | Annual acres of forested vegetation active restoration activities* | 16,950 | 17,400 | 14,000 | 20,100 | 23,400 | 18,700 |
| | Total acres of MA 4A (and 4C**) | 300,177 | 640,300 | 423,800 | 742,300 | 625,200 | 625,200 |
| | Percent of MA 4A (and 4C**) treated annually | 6 | 3 | 3 | 3 | 4 | 3 |
| WAW | Annual acres of forested vegetation active restoration activities* | 17,650 | 18,150 | 14,450 | 22,650 | 23,450 | 19,850 |
| | Total acres of MA 4A and 4C | 673,085 | 848,000 | 488,200 | 998,700 | 844,300 | 844,300 |
| | Percent of MA 4A and 4C treated annually | 3 | 2 | 3 | 2 | 3 | 2 |

* Estimated annual acres of forested vegetation active restoration activities include harvest treatments, planting, noncommercial thinning, and prescribed burning outside of harvest units.

**Alternatives A and C also include acres of management area 4C (old forest).

Within the Malheur National Forest, all of the alternatives, except for alternative B, would treat approximately 2 percent of MA 4A annually. However, alternative D would contain the greatest number of acres of general forest and would contain the greatest number of acres of annual forested vegetation active restoration activities. The number of acres of annual active restoration activities would be only slightly lower under alternative E, compared to alternative D. Alternative C would contain the fewest acres of annual active restoration activities. However, alternative C would treat approximately 2 percent of MA 4A and 4C because the total acres of these two management areas are less under alternative C, compared to the other action alternatives.

Within the Umatilla National Forest, alternative A would treat approximately 6 percent of MA 4A and 4C annually. However, alternative A would contain the fewest number of acres of MA 4A and

4C. While alternative E would treat approximately 4 percent of MA 4A annually, it would contain over 300,000 acres more of general forest than alternative A. Alternatives B, C, D, and F would treat approximately 3 percent of MA 4A (and 4C for alternative C) annually. However, the number of acres of MA 4A (and 4C under alternative C) would vary greatly between these alternatives. Alternative C would contain the fewest acres of annual active restoration activities. Alternative C would also contain the fewest number of acres of MA 4A and 4C of the action alternatives. Alternative D would contain the greatest number of acres of general forest of all of the alternatives.

Within the Wallowa-Whitman National Forest, alternatives A, C, and E would treat approximately 3 percent of MA 4A (and 4C for alternative C) annually. However, alternative C would contain the fewest number of acres of MA 4A and 4C. While alternative E would treat approximately 3 percent of MA 4A annually, it would contain over 350,000 acres more of general forest than alternative C. Alternatives B, D, and F would treat approximately 2 percent of MA 4A annually. However, alternative D would contain approximately 150,000 acres more of MA 4A. Alternative C would contain the fewest acres of annual active restoration activities. Alternative C would also contain the fewest number of acres of MA 4A and 4C of the action alternatives.

Figure 14 illustrates a comparison of the approximate number of years required to complete forested vegetation active restoration activities within all of MA 4A (and 4C for alternatives A and C) under each alternative within each national forest. The number of years was calculated by dividing the total number of acres of MA 4A (and 4C for alternatives A and C) under each alternative by the estimated number of acres of annual active restoration activities under each alternative. This analysis was conducted to compare the rates at which active restoration activities could occur under each of the alternatives. Under each alternative, not every acre within MA 4A (and 4C under alternatives A and C) would necessarily be treated. The specific areas requiring treatment would be identified during project-level NEPA analysis or other landscape-level planning efforts.

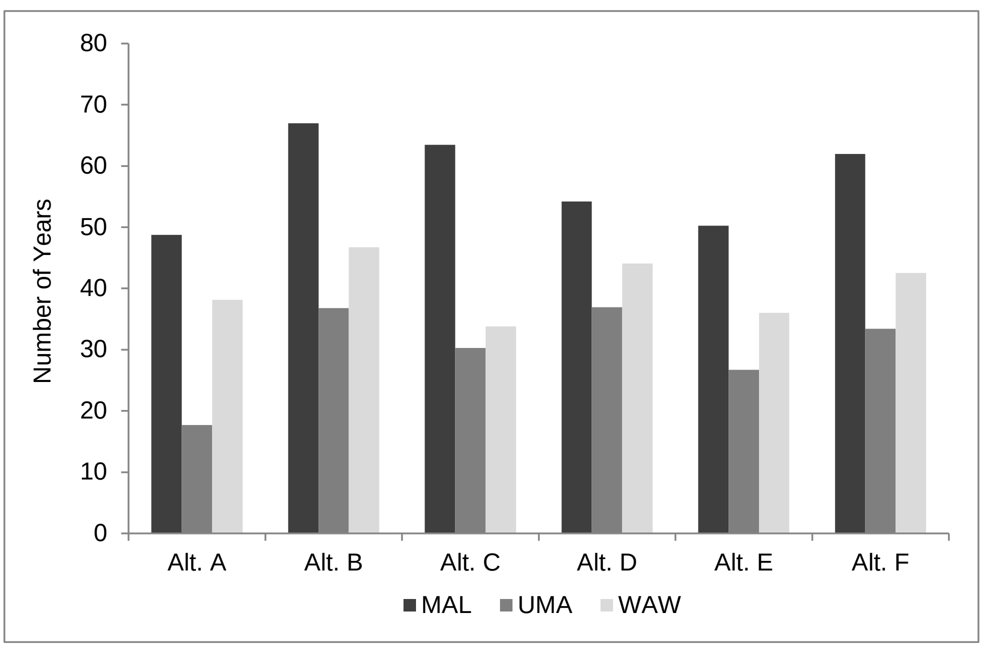


**Figure 14. Comparison of the approximate number of years required to complete forested vegetation active restoration activities within management area 4A and 4C under each alternative within each national forest**

All of the alternatives contain the same desired conditions for forested vegetation (forested structural stages, species composition, stand density, fire regime condition class). One of the main differences between the alternatives in terms of forested vegetation would be whether the alternatives achieve these desired conditions and the number of years required to achieve the desired conditions. The alternatives that result in the closest achievement of the desired conditions for forested vegetation in the shortest amount of time and across the largest number of acres would result in the greatest improvement in ecological resilience of forested vegetation. The rate and scale at which the desired conditions would be achieved is important because the pace of restoration activities has not kept up with the need resulting from fire suppression. Fire suppression over the past century has resulted in fuel accumulation, altered species composition, increased stand densities, altered stand structures, and an increased risk of catastrophic, stand-replacing events.

Within the Malheur National Forest, alternatives A and E would require the fewest number of years (49 and 50 years, respectively) to complete forested vegetation active restoration activities within MA 4A (and 4C for alternatives A and C). Alternative A would require the fewest number of years because this alternative would contain the fewest number of acres of MA 4A and 4C. Alternatives B, E, and F would contain approximately the same number of acres of MA 4A. At the estimated rate of 24,800 acres annually, all acres could potentially be treated within approximately 50 years under alternative E. Although alternative D would require approximately 54 years to complete active restoration activities, alternative D would include an additional 100,000 acres of MA 4A, resulting in higher levels of active restoration over the long-term within Malheur National Forest. Alternatives B and C would require the greatest number of years (67 and 63 years, respectively) to complete active restoration activities within MA 4A (and 4C under alternative C). Additionally, under alternative C, MA 4A and 4C would constitute approximately 300,000 acres to 400,000 acres less than alternatives B, D, E, and F, resulting in lower levels of active restoration over the long-term within the Malheur National Forest.

Within the Umatilla National Forest, alternative A would require the fewest number of years (18 years) to complete forested vegetation active restoration activities within MA 4A and 4C. Alternative A would require the fewest number of years because this alternative would contain the fewest number of acres of MA 4A and 4C. Alternatives B, E, and F would contain approximately the same number of acres of MA 4A. At the estimated rate of 23,400 acres annually, all acres of MA 4A could potentially be treated within approximately 27 years under alternative E. Although alternative C would require approximately 30 years to complete active restoration activities, alternative C would include approximately 200,000 fewer acres of MA 4A and 4C, compared to alternative E. Alternatives B and D would require the greatest number of years (37 years) to complete active restoration activities within MA 4A. However, alternative D would include an additional 100,000 acres of MA 4A, compared to alternatives B, E, and F, resulting in higher levels of active restoration over the long-term within the Umatilla National Forest. Alternatives A and C would contain the fewest number of acres of MA 4A and 4C, resulting in lower levels of active restoration over the long-term within the Umatilla National Forest.

Within the Wallowa-Whitman National Forest, alternative C would require the fewest number of years (34 years) to complete forested vegetation active restoration activities within MA 4A and 4C. Although alternative C would require the fewest number of years, this alternative would contain approximately 185,000 to 500,000 fewer acres of MA 4A and 4C, in comparison to the other alternatives. Alternatives B, E, and F would contain approximately the same number of acres of MA 4A. At the estimated rate of 23,450 acres annually, all acres of MA 4A could potentially be treated within approximately 36 years under alternative E. Alternatives B and D would require the greatest number of years (approximately 47 and 44 years, respectively) to complete active restoration activities within MA 4A. However, alternative D would include an additional 150,000 acres of MA 4A, compared to alternatives B, E, and F, resulting in higher levels of active restoration within the Wallowa-Whitman National Forest. Alternatives A and C would contain the fewest number of acres of MA 4A and 4C, resulting in lower levels of active restoration over the long-term within the Wallowa-Whitman National Forest.

### *Road Treatments in Priority Watersheds*

The emphasis of road-related treatment objectives, as stated in appendix A, is to reduce road-related sedimentation by reducing the hydrological connectivity of National Forest System roads. Hydrologically connected roads are defined as roads or portions of roads that route water and/or sediment directly to stream channels. The extent of hydrologically connected roads was estimated using GIS and approximated by the miles of roads occurring within a set distance of streams. The method provides an approximation that is used to compare alternatives.

The hydrologic connectivity of the road system would be substantially reduced for alternatives C and D, and somewhat reduced for the other action alternatives (table 111).

**Table 111. Miles of road treatments in priority watersheds for each alternative for each national forest**

| National Forest | Alternative A | Alternative B | Alternative C | Alternative D | Alternative E | Alternative F |
|---|---|---|---|---|---|---|
| MAL | 260 | 260 | 600 | 650 | 290 | 310 |
| UMA | 260 | 260 | 450 | 800 | 300 | 270 |
| WAW | 260 | 260 | 400 | 800 | 300 | 270 |

### *Forage Use in Priority Watersheds*

Livestock use intensity, as defined by Holechek et al. (2006), is an estimate of forage use by domestic livestock relative to long-term average forage production and is used to manage livestock use to be consistent with the inherent productivity of rangeland sites. Forage production for all vegetation types was estimated using methods described in the grazing land vegetation section of this document (see the Livestock Grazing and Rangeland Vegetation section) and Johnson (1987, 1992) and was summed by subwatershed. Forage use was estimated by summing animal unit months (AUMs) by subwatershed and converting AUMs to forage use with methods described in the Forest Service Handbook (FSH 2209.13 chapter 90).

Average use levels are expected to be the same for alternatives A, B, E, and F (table 112). Average use levels would increase slightly for alternative D. Use intensity would be substantially reduced for alternative C.

**Table 112. Average percent of forage use intensity in priority watersheds for each alternative for each national forest**

| National Forest | Alternative A | Alternative B | Alternative C | Alternative D | Alternative E | Alternative F |
|---|---|---|---|---|---|---|
| MAL | 15.9% | 15.9% | 3.8% | 17.0% | 15.9% | 15.9% |
| UMA | 11.4% | 10.6% | 0.8% | 13.8% | 10.6% | 10.6% |
| WAW | 12% | 12% | 3% | 17% | 12% | 12% |

### *Improved Riparian Areas*

The measure for improved riparian areas (objective) is stream miles and could include reconnection of the floodplain, stabilizing stream banks, restoring channel morphology, and addition of large wood in streams. Because channel reconstruction is costly to design and implement, the number of miles completed in any year would vary and usually would be small. However, there are a variety of actions or methods that could be used to improve stream channel and aquatic habitat conditions in lieu of channel reconstruction.

Active channel restoration is expected to occur in 6 to 9 percent of stream miles in priority watersheds, depending in the alternative selected. The fewest stream miles would be restored for alternatives B and D, while the most miles treated would occur for alternatives C and E (table 113).

**Table 113. Miles of improved riparian areas for each alternative for each national forest**

| National Forest | Alternative A | Alternative B | Alternative C | Alternative D | Alternative E | Alternative F |
|---|---|---|---|---|---|---|
| MAL | 300 | 300 | 600 | 300 | 450 | 400 |
| UMA | 150 | 150 | 300 | 150 | 225 | 210 |
| WAW | 250 | 250 | 500 | 250 | 375 | 350 |

## Key Indicators to Reflect Resilient Conditions

### *Improvement in the Dry Upland Forest Potential Vegetation Group Fire Regime Condition Class Departure Score*

The changes in vegetation and fire regime condition class departure scores would be the result of the activities listed in table 108 through table 113, as well as growth and mortality due to insects, disease, and wildfire. Forested vegetation active restoration activities would increase the Blue Mountains national forests' resilience to disturbance in the long term by improving tree vigor and stand structure, retaining a suitable mix of tree species for the site, and by reducing both surface and aerial fuels in accordance with the desired conditions. The resulting retention of forest cover after disturbances that affect all or part of a forest stand would help to ensure that a variety of ecosystem services associated with forested vegetation are provided continuously. The resulting improvement in stand structure, species composition, and ecological resilience could also improve wildlife habitat for some species. Those alternatives that are projected to make the most progress towards achieving the forested vegetation desired conditions (structure, function, and composition) would result in the most ecologically resilient conditions.

Table 114 displays the fire regime condition class departure scores by potential vegetation group under each of the alternatives projected over 50 years by national forest. The departure values for fire regime condition class are based on a score of zero to 100, with a departure score of zero indicating the least amount of departure between the existing and desired conditions/HRV and a departure score of one hundred indicating the maximum amount of departure between the existing and desired conditions/HRV. A score of less than 33 would be considered low departure from the HRV (condition class 1). A departure score of 33 to 66 would be considered moderate departure from the HRV (condition class 2). A departure score of greater than 66 would be considered high departure from the HRV (condition class 3). Fire regime condition class departure scores were calculated for all upland forest potential vegetation groups. A more thorough discussion of all upland forest potential vegetation groups can be found in the Forested Vegetation, Timber Resources, and Wildland Fire section of this document. The discussion regarding ecological resilience uses the dry upland forest potential vegetation group fire regime condition class departure scores as a key indicator because 60 to 90 percent of all harvest treatments would occur within this potential vegetation group and because forested vegetation within this potential vegetation group tends to be the most departed from the HRV.

**Table 114. Fire regime condition class departure scores within the dry upland forest potential vegetation group for each alternative by national forest**

| National Forest | Year | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|---|
| MAL | Existing condition | 62 | | | | | |
| | 20 | 55 | 53 | 56 | 47 | 50 | 53 |
| | 50 | 47 | 45 | 48 | 33 | 36 | 43 |
| UMA | Existing condition | 60 | | | | | |
| | 20 | 56 | 55 | 57 | 49 | 50 | 53 |
| | 50 | 48 | 46 | 50 | 39 | 39 | 43 |
| WAW | Existing condition | 56 | | | | | |
| | 20 | 57 | 57 | 58 | 52 | 54 | 56 |
| | 50 | 53 | 52 | 54 | 47 | 47 | 50 |

Within the Malheur dry upland forest potential vegetation group, all of the alternatives would result in moderate departure of fire regime condition class (class 2) at year 50 due to the relatively large amount of departure between existing conditions and the HRV. However, alternatives D and E would result in the greatest improvement in fire regime condition class departure scores at year 50. Under alternatives D and E, the fire regime condition class departure scores would be approximately 33 and 36, respectively, at year 50. Under Alternative D, vegetation within the dry upland forest potential vegetation group would be very close to low departure (condition class 1) at year 50 at the scale of the Malheur National Forest. However, condition class 1 may be achieved sooner in some individual watersheds that currently have significant amounts of large mid-aged forests that are more than 100 years old. For many areas that currently have 80 to 100 year old forests, it would take more than 50 years for those forests to grow into the larger and older age and size classes commonly associated with the definition of old forest.

Within the Umatilla dry upland forest potential vegetation group, all of the alternatives would result in moderate departure of fire regime condition class (class 2) at year 50 due to the relatively large amount of departure between the existing conditions and the HRV. However, alternatives D and E would result in the greatest improvement in fire regime condition class departure scores at year 50. Under alternatives D and E, the fire regime condition class departure scores would be approximately 39 at year 50. Under alternatives D and E, vegetation within the dry upland forest potential vegetation group would be close to achieving low departure from the HRV (condition class 1) at the scale of the Umatilla National Forest. However, condition class 1 may be achieved sooner in some individual watersheds that currently have significant amounts of large mid-aged forests that are more than 100 years old. For many areas that currently have 80 to 100 year old forests, it would take more than 50 years for those forests to grow into the larger and older age and size classes commonly associated with the definition of old forest.

Within the Wallowa-Whitman dry upland forest potential vegetation group, all of the alternatives would result in moderate departure of fire regime condition class (class 2) at year 50 due to the relatively large amount of departure between the existing conditions and the HRV. However, alternatives D and E would result in the greatest improvement in fire regime condition class departure scores at year 50. Under alternatives D and E, the fire regime condition class departure scores would be approximately 47 at year 50.

Under alternatives D and E, departure scores would be lower due to the increased levels of timber harvest activities, mechanical fuels treatments, and/or prescribed burning associated with these alternatives. Alternatives D and E would also show improvement at a faster rate because of the increased harvesting of smaller trees within the old forest, which may decrease mortality in older age classes (due to decreased moisture stress and fire severity) and modify closed canopy to open canopy. However, alternative D would not include prescribed burning outside of harvest units and would include decreased amounts of prescribed burning within harvest units. Under this alternative, the majority of fuels treatments within harvest units would be accomplished by removal or crushing instead of burning.

Because alternative E includes the reintroduction of fire to the ecosystem in addition to reducing the amount of departure in the dry upland forest vegetation, alternative E would be expected to result in increased ecological resiliency in the dry upland forest potential vegetation group. With this alternative, fuel composition, fire frequency, severity, pattern, and other associated disturbances would more closely resemble the HRV. Under alternative E, the risk of fire behavior, effects and associated disturbances would be similar to those that occurred prior to interruption of the historical low severity fire regime. Although the risk of loss of key ecosystem components, such as native species, large trees, and soil, would be lower under both alternatives D and E, the lack of fire under alternative D would inhibit other ecological processes. Fire is essential to nutrient cycling in fire adapted ecosystems. Fire has a fertilizer effect on the soil by increasing ammonium levels and microbial nitrogen mineralization, resulting in increased nutrient levels in both understory and overstory vegetation. Fire rejuvenates desirable grasses, depending on the species response to disturbance (i.e., sprouters, prolific seeders, and species with strong rhizome extension respond favorably to fire). Especially in combination with reduced stand densities, fire results in changes in the microclimate on the forest floor, specifically increased sunlight penetration, increased soil temperatures, and increased understory productivity. Fire has been shown to result in significant increases in herbaceous biomass, species richness, and understory productivity and diversity. Depending on timing, fire may also increase seedling establishment by aiding in seed bed and site preparation. Fire would also aid in the creation of openings for regeneration.

Under alternative C, the fire regime condition class departure score would be higher than the other alternatives at year 50 within the dry upland forest potential vegetation group within all three national forests. Under alternative C, the fire regime condition class departure score would range from approximately 48 to 54 within all three national forests at year 50. Conditions would be more highly departed from the HRV under alternative C due to increased stand densities and altered species compositions resulting from the lower levels of timber harvest and prescribed burning associated with this alternative. Alternative C would result in decreased ecological resiliency in the Wallowa-Whitman dry upland forest potential vegetation group because vegetation characteristics and other conditions would least resemble the HRV. The risk of loss of key ecosystem components, such as native species, large trees, and soil, would be greatest under alternative C due to an increased risk of uncharacteristically severe fire behavior.

#### *Number of Subwatersheds in Improved Watershed Condition Class*

A watershed condition model was used to assess watershed riparian and aquatic habitat conditions on National Forest System lands. Three primary attributes are used to represent hillslope conditions within subwatersheds: forested vegetation condition, roads, and use intensity by domestic livestock. These attributes influence the routing of water and sediment from hillslopes to stream channels.

Watershed condition is a function of both aquatic and terrestrial factors. Activities, such as road maintenance, can improve watershed condition by reducing the amount of sediment introduced into streams and reducing the hydrologic connectivity between streams and roads. Treatments that improve forested vegetation conditions, reduce detrimental soil conditions, restore floodplains, improve riparian species composition, increase stream shade, increase aquatic habitat complexity, and improve aquatic habitat connectivity can increase the resilience of watersheds and help ensure that ecosystem services are provided continuously.

Together, vegetation condition, roads, and livestock grazing intensity comprise 50 percent of the watershed condition scores for individual watersheds. Measures of riparian and aquatic habitat condition comprise the remaining 50 percent of watershed condition scores.

For the Malheur and Wallowa-Whitman National Forests, alternative C would have the most watersheds in improved watershed condition class at year 10, followed by alternative E (table 115). Watersheds would improve the least for alternative D. For the Umatilla National Forest, the alternatives would have little variation in improved watersheds at year 10.

**Table 115. Number of subwatersheds in improved condition class in10 years for each alternative for each national forest**

| National Forest | Alternative A | Alternative B | Alternative C | Alternative D | Alternative E | Alternative F |
|---|---|---|---|---|---|---|
| MAL | 16 | 16 | 42 | 18 | 21 | 21 |
| UMA | 23 | 23 | 25 | 25 | 23 | 23 |
| WAW | 4 | 4 | 14 | 2 | 5 | 4 |

### *Alternative A Watershed Condition Summary*

Alternative A would continue current management direction, which includes a mix of protection strategies and active management. Watershed protection and restoration would proceed at current levels, though watershed restoration is not integral to forest plan direction as amended by PACFISH and INFISH. Current direction includes planning area wide strategies for watershed protection and passive restoration. Emphasis on watershed protection and restoration would be slightly less than alternatives B, C, E, and F because of differences in riparian habitat conservation areas for intermittent streams in watersheds where no listed fish species are present, and because of lower projections for restoration. For the short term (10 to 15 years), watershed condition would be maintained and improved at current rates. For the long term (greater than 20 years), watershed conditions would continue to improve but at a slower rates (fewer watersheds in improving condition) compared to alternatives B, C, E, and F because of differences in protection and restoration levels for the alternatives.

## Action Alternatives Watershed Condition Summaries

Alternatives B, C, E, and F include strategies for the plan area for riparian area protection and active restoration that likely would result in accelerated improvement in riparian area condition and the maintenance and improvement of lakes, streams, and rivers, though at varying rates, for the short and long term.

Alternative B includes a mix of protection and restoration that would improve watershed conditions and water quality more than alternative A but less than alternatives C, E, and F for the short and long term because of slightly lower levels of protection and restoration.

Alternative C would have the highest level of riparian area protection and restoration and would result in the greatest improvement in riparian condition for the short and long term. This alternative would provide a greater level of protection (wider riparian management areas) and less active management (vegetation, grazing, motor vehicle recreation). For the long term, there would be an increased risk of disturbance associated with limited active vegetation treatment particularly in dry forest types. Long term benefits to watershed condition would potentially be reduced.

Alternative D would emphasize commodity production and would have the lowest levels of riparian area protection and restoration of hydrologic and riparian function but would have the highest level of active vegetation management. Improved vegetation resilience would contribute to improved watershed conditions but would likely result in a declining trend in overall watershed improvement. A potential for degradation of watershed condition and water quality exists in some areas, because of relatively high objective levels for timber harvest, road use, and livestock grazing. This alternative would pose the greatest short- and long-term risk to watershed function and water quality, though upland vegetation conditions would be improved at the fastest rate.

Alternatives E and F include a mix of riparian area protection and active forested vegetation restoration that would, over the short term, improve watershed conditions more than alternatives B and D, but less than alternative C. These alternatives include desired conditions for road densities in anadromous and bull trout watersheds and specific guidelines for range management that would, during the long term, also contribute to improving trends in watershed condition and water quality in affected watersheds. Although less than alternative D but more than the other action alternatives, alternative E would provide greater emphasis on vegetation restoration and, during the short term, would pose a slightly greater risk to watershed conditions. For the long term, both alternatives would improve watershed conditions and water quality at a slightly slower rate than alternative C because of the levels of protection and amount of active restoration, including vegetation and roads management direction.

## Summary of Key Indicators

Table 116 through table 118 display a summary of the key indicators used in the analysis of ecological resilience. The gray boxes depict the alternatives that result in either the greatest level of management activities designed to maintain or restore ecological resilience or the greatest improvement in key indicators used to reflect resilient conditions. Alternatives D and E would include the greatest number of acres of active restoration activities per year, resulting in the lowest fire regime condition class (FRCC) departure scores within the dry upland forest potential vegetation group (PVG) at year 50. Vegetation composition, structure, and density would be less departed from the HRV. Alternatives D and E would contain the greatest number of acres of general forest. Therefore, vegetation would potentially be restored to within or near the HRV within a greater percent of the landscape under alternatives D and E. However, alternative D would not include prescribed burning outside of harvest units and would include decreased amounts of prescribed burning within harvest units. Under alternative D, the majority of fuels treatments within harvest units would be accomplished by removal or crushing instead of burning. Because alternative E includes the reintroduction of fire to the ecosystem in addition to reducing the amount of departure in the dry upland forest vegetation, alternative E would be expected to result in the greatest increase in ecological resilience in the dry upland forest vegetation.

**Table 116. Summary of ecological resilience key indicators for the Malheur National Forest**

| Key Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| Annual forested vegetation active restoration activities (acres) | 18,100 | 18,700 | 14,300 | 25,100 | 24,800 | 20,100 |
| Miles of road treatments | 260 | 260 | 600 | 650 | 290 | 310 |
| Forage use intensity | 15.9% | 15.9% | 3.8% | 17.0% | 15.9% | 15.9% |
| Miles of riparian area improvement | 300 | 300 | 600 | 300 | 450 | 400 |
| Number of subwatersheds in improved condition | 16 | 16 | 42 | 18 | 21 | 21 |
| FRCC departure score within the dry upland forest PVG at year 50 | 47 | 45 | 48 | 33 | 36 | 43 |

**Table 117. Summary of ecological resilience key indicators for the Umatilla National Forest**

| Key Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| Annual forested vegetation active restoration activities (acres) | 16,950 | 17,400 | 14,000 | 20,100 | 23,400 | 18,700 |
| Miles of road treatments | 260 | 260 | 450 | 800 | 300 | 270 |
| Forage use intensity | 11.4% | 10.6% | 0.8% | 13.8% | 10.6% | 10.6% |
| Miles of riparian area improvement | 150 | 150 | 300 | 150 | 225 | 210 |
| Number of subwatersheds in improved condition | 23 | 23 | 25 | 25 | 23 | 23 |
| FRCC departure score within the dry upland forest PVG at year 50 | 48 | 46 | 50 | 39 | 39 | 43 |

**Table 118. Summary of ecological resilience key indicators for the Wallowa-Whitman National Forest**

| Key Indicator | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| Annual forested vegetation active restoration activities (acres) | 17,650 | 18,150 | 14,450 | 22,650 | 23,450 | 19,850 |
| Miles of road treatments | 260 | 260 | 400 | 800 | 300 | 270 |
| Forage use intensity | 12% | 12% | 3% | 17% | 12% | 12% |
| Miles of riparian area improvement | 250 | 250 | 500 | 250 | 375 | 350 |
| Number of subwatersheds in improved condition | 4 | 4 | 14 | 2 | 5 | 4 |
| FRCC departure score within the dry upland forest PVG at year 50 | 53 | 52 | 54 | 47 | 47 | 50 |

Healthy, resilient landscapes have a greater capacity to survive natural disturbances and large-scale threats to sustainability, especially under changing and uncertain future environmental conditions, such as those driven by climate change and increasing human uses. The ecological resilience issue is complex, involving physical and biological factors as well as human actions. Risks to resilience arise from many sources, both natural and human caused. Reducing risks in one component of the ecosystem may increase risks in others. No one alternative best addresses the issue of ecological resilience. Reliance on natural processes may be the fastest way to achieve desired conditions for some ecosystem components, while others components may require active restoration.

# Physical Environment

## Soils

### Background

Individual soils are a product of geologic parent material as modified by the effects of weather, topography, biota, and time (Jenny 1941). Paul and Clark (1996) expand the definition of biota to include above ground vegetation as well as the variety soil organisms responsible for nutrient exchange between soils and vegetation and the decomposition of organic material responsible for the development of upper soil horizons**.**

Soils in the Blue Mountains are derived from a variety of geologic parent materials that include Paleozoic and Mesozoic sedimentary, metamorphic, and igneous rocks, of which the oldest are associated with parts of at least five known accreted terranes in northeast Oregon. These older rocks are overlain by Cenozoic Columbia River basalts, and younger volcaniclastic sediments, volcanic ash, lake sediments, glacial debris, and other rocks (Vallier and Brooks 1995). Because precipitation increases and temperature generally decreases from low elevation to high elevation, and the dominant form of precipitation changes from rain to snow with elevation, the extent of soil development, soil depth, texture, and other properties vary greatly across the Blue Mountains. Soils vary from deep, well-developed and highly productive to shallow, skeletal soils of low productivity.

About 68 percent of soils are on National Forest System lands in the Blue Mountains are derived from volcanic rocks. Seventy-four percent of volcanic soils, or 40 percent of the total are derived from Columbia River basalts, and 26 percent (28 percent of total) from other volcanic rocks. Ten percent of soils are derived from igneous intrusive rocks, eleven percent from metamorphic rocks, seven percent from sedimentary rocks, and three percent from other rock types. From 30 to 60 percent of all soils have volcanic ash deposits of varying thickness derived from the eruption Mount Mazama roughly 6800 years ago that overlie previously developed soils (USDA Forest Service 1990a, 1990c). Ash soils developed on top of pre-existing soils of all types and are among the most, if not the most productive of all soils in the Blue Mountains (Geist and Strickler 1978). The productivity of volcanic ash soils is derived from higher water holding capacity and higher organic matter content compared to all other soils.

Soils have biological, chemical, and physical properties that are fundamental to the productivity of forest ecosystems and play an integral role in the hydrological behavior of watersheds (Neary et al. 2009). Soils provide water and nutrients for vegetation, provide support for individual plants, absorb precipitation and regulate the quantity and timing of stream flow, provide habitats for a wide variety of wildlife (above and below ground), buffer effects of pollutants, and store and release carbon. Other resource values, such as water quality and quantity, wildlife habitat, and biomass production, are often dependent on and closely related to properly functioning and productive soils.

Undisturbed forest soils have forest floors composed of litter and organic material that protects the soil surface. Litter layers are underlain by a layer of decomposed organic matter, or humus, which is underlain by mineral soil. The high porosity of surface soil layers normally results in soils with high infiltration capacities and low erosion rates when undisturbed. Disturbance that results in loss of surface layers can result in loss of a substantial portion of soil organic matter, nutrients, and soil biota that are key to soil productivity (Everett et al. 1991).

Shrubland and grassland soils may have a soil surface that is protected by a biotic crust consisting of cyanobacteria, green algae, lichens, mosses, microfungi, and other bacteria (Belnap et al. 2001). Biotic soil crusts occupy the spaces between higher plants and form a thin matrix on the soil surface that protects against erosion, fixes atmospheric nitrogen, plays a key role in the dynamics of other nutrients, and helps retain soil moisture. Under undisturbed conditions, biotic soil crusts may consists of nearly 100 distinct species (Root and McCune 2012). Disturbance of soil crusts may result in lowered species diversity or loss of the crust and exposure of surface soils to erosion and soil loss, depending on the severity of disturbance (Ponzetti and McCune 2001). Partial breakdown of soil crusts is also observed to create areas of bare ground that may be more easily colonized by invasive, non-native species (Reisner et al. 2013)

The Blue Mountains physiographic province, which includes the Blue Mountains national forests, is characterized by a diverse landscape ranging from river and valley bottoms to steep mountain slopes, deeply dissected canyons, and mountain and plateau tops (USDA Forest Service 2006). Landform type and topography directly influence soil characteristics and productivity and erosional, sedimentation, and hydrologic processes; specifically mass wasting, surface erosion, and runoff (USDA Forest Service 2006). Individual soils are a product of geologic parent material being modified by the effects of weather, topography, biota, and time (Brady and Wells 1999). Soils provide water and nutrients for vegetation, provide support for individual plants, absorb precipitation and regulate quantity and timing of stream flow, provide habitats for a wide variety of wildlife (above and below ground), buffer effects of pollutants, and store and release carbon. Other resource values, such as water quality and quantity, wildlife habitat, and biomass production, are often dependent on and closely related to properly functioning soils.

Soil moisture and temperature significantly influence each soil’s productive potential and how it responds to disturbances. Given the variation in topography and atmospheric moisture within the Blue Mountains, there is a consequent variation in local climatic conditions. Diurnal fluctuations in both temperature and moisture are also important environmental variables and are influenced to a large extent by elevation and aspect. Soil moisture and temperature regimes are reflected by the kinds of vegetation occurring on a landscape. Both yearly and daily fluctuations in temperature and moisture can be influenced by management activities (vegetation management and surface soil removal).

A summary of general soil types in the Blue Mountains is in the land type associations (LTAs) description (Sasich and Ottersberg 2006) and GIS layer. Land type associations are differentiated based on (1) vegetation zones, (2) geology groups, and (3) landforms. There are 80 land type associations in the Blue Mountains. In addition to the three characteristics that differentiate the land type associations, Sasich and Ottersberg (2006) give information on volcanic ash, texture, rock fragments, depth to bedrock, soil climate, hydrologic and sedimentation properties and responses, productivity, vegetation recovery, limitations for roads and heavy machinery operability, timber and range suitability, and other characteristics. More detailed, site-specific soil information for most of Umatilla and Wallowa-Whitman National Forests and the northern part of the Malheur National Forest is in the Terrestrial Ecological Unit Inventory (TEUI) GIS layer and database. For areas that lack TEUI, Soil Resource Inventory information is available for each national forest at an intermediate scale.

The Blue Mountains are a moisture-limited region especially when compared to the Cascade Range. Many of the lower elevation soils are dry for at least 60 to 90 days during summer. The active growing season is effectively shortened by early moisture stress. In addition, many of the lower elevation soils lack a volcanic ash mantle. This reduces effective soil depth and increases soil droughtiness because such soils generally contain more coarse rock fragments (gravel-size and larger) throughout the profile that reduce plant available water. In xeric (dry) soil moisture regimes, lack of water limits organic matter production and slows soil genesis. On some xeric soils, organic matter accumulates in thick, dark topsoil. Productivity on soil that lack this thick topsoil is dependent on a surface organic matter layer (forest floor) as well as topsoil. Some soils benefit from regular low intensity fires to release nutrients accumulated in woody debris and the forest floor.

**Biological Soil Crusts** – Biological soil crusts are critical for stabilizing the surface soil and trapping sediment in grazing lands, particularly in dry non-forested and dry forested grazing lands. Biological soil crusts also function as living mulch by retaining soil moisture and discouraging annual weed growth on moisture-limited sites (Belnap et al. 2001). Disturbances, such as livestock grazing, fire, areas of seasonally (winter and spring) intense wild ungulate use, natural erosion processes (specifically sheet erosion), and off road vehicle use, contribute to a complex mosaic of biological soil crust composition and abundance. Frequent or continuous disturbance from grazing keeps the biological soil crust communities at an early successional stage (USDA Forest Service 1999; Brooks 2009). The degree of degradation of soil crusts is related to soil type (specifically soil texture) and soil moisture.

## Affected Environment – Soils

Soil quality in Blue Mountains national forests has been altered to varying degrees in some locations by past land uses, such as timber harvest, fuels reduction activities, livestock grazing, road and trail construction, wildland fire suppression activities, introduction of invasive plant species, and motor vehicle use off of roads. Effects of these activities on soils and other resources depends on local soil characteristics and may include reduced ground cover, altered vegetative conditions, decreased infiltration rates, increased runoff and surface erosion rates, and depressed potential site productivity.

### Soil Quality Standards

Following passage of the National Forest Management Act (NFMA) in 1976, regions of the U.S. Forest Service standards and guidelines for the protection of forest soils. In the Pacific Northwest region (Region 6), forest soil quality standards were in effect by 1979 and formalized in 1983 (Howes et al. 1983). Region 6 standards addressed changes in soil compaction and displacement and set limits on the areal extent of disturbance that was considered detrimental to soil productivity. In 1998, an R6 supplement to the Forest Service Watershed Protection and Management Manual (FSM 2520, 1998) defined the soil quality standards and guidelines that are still in effect on forests in the Pacific Northwest region:

Leave a minimum of 80 percent of an activity area in an acceptable soil quality condition. Detrimental conditions, as defined below, also include landings and system roads. It is assumed that roads and landings comprise 5 percent of an activity area, and that all other soil disturbance should not be more than 15 percent of any area. Detrimental soil conditions and the accompanying criteria for determining when and where these conditions occur were defined for compaction, puddling, displacement, and detrimentally burned soils as follows:

**Detrimental compaction**. For volcanic ash soils, an increase of 20 percent bulk density, or more, above undisturbed soils of the same type. For all other soils, an increase of 15 percent bulk density, compared to undisturbed soils, a 50 percent reduction in macropore space , and/or a reduction in macropore space below 15 percent is defined as detrimental disturbance.

**Detrimental puddling** is defined as depth of ruts or imprints of six inches or more, accompanied by deformation of the soil profile.

**Detrimental displacement** is the removal of more than 50 percent of the A horizon from an area greater than 100 square feet, which is at least 5 feet in width.

**Detrimental burned soils** are soils in which the mineral soil surface has been significantly changed in color, oxidized to a reddish color, and the next one-half inch blackened from organic matter charring by heat conducted through the top layer. The detrimentally burned soil standard applies to an area greater than 100 square feet, which is at least five feet in width.

**Detrimental surface erosion** is visual evidence of surface loss in areas greater than 100 square feet, rills or gullies and/or water quality degradation from sediment or nutrient enrichment.

**Detrimental soil mass wasting** includes any visual evidence of landslides or mass movement associated with land management activities and/or that degrades water quality.

In addition to soil quality standards, guidelines were implemented that included retention of soil organic matter, coarse woody material, and maintenance and protection of soil moisture regimes.

Methods were established for monitoring the disturbance following timber harvest (Howes et al. 1983) and implemented on National Forest System lands in the Blue Mountains. Early monitoring reports on the Wallowa-Whitman national forest revealed very high disturbance in some harvest units indicating that soil quality standards were not being met. Reports on the La Grande Ranger District indicated total disturbance on some harvest units of up to 97 percent of the area, and nearly 60 percent of the area detrimental disturbed. Review of these early reports was followed by the implementation of additional actions to protect soils and included limiting the density of skid trails, limiting the distance from established trails that equipment would be allowed to operate, retaining slash and coarse woody debris on site to cushion soils and prevent compaction. It was found that by following these additional guidelines during timber harvest and slash treatment that regional soil quality standards could be met.

It has also been observed that the amount of disturbance varies by harvest type and the type of equipment used. Ground based and tractor harvest operation typically resulted in high detrimental soil disturbance rates. Skyline logging and cut-to-length harvest resulted in lower levels of soil disturbance.

Sullivan (1988) reported the results of monitoring of 24 harvest units on the Malheur national forest between 1981 and 1985. Fifteen of 24 harvest units were found with detrimental soil conditions exceeding regional standards with the majority of disturbance resulting from soil compaction.

Geist et al. (1989) reported that compaction on five of eleven harvest units monitored 14 to 23 years following harvest on the Malheur, Umatilla and Wallowa-Whitman national forests exceeded regional standards. Review of these results by Miller et al. (2010) suggests that all of the units would be considered as having exceeded regional standards after including the area disturbed by roads, but caution that the results depend on the accurate determination of undisturbed soil bulk density.

The 2001 monitoring report for the national forests documented evaluations of soil conditions on several planned and completed projects. Within the Malheur National Forest, all but 4 of the 18 units sampled had less than the 20 percent maximum detrimental soil impact specified by the forest plan. Over-the-snow operations resulted in greatly reduced detrimental soil conditions versus levels resulting from dry season operations.

Monitoring results for 18 harvest units on the Umatilla national forest in 2001 showed that none exceeded soil quality standards and that 12 units harvest using cut-to-length harvest methods averaged 4.5 percent detrimental disturbance. Adjustments in treatment methods made after the 1990 forest plan was implemented resulted in a reduction in detrimental impacts to soils. No sampled units exceeded the forest plan thresholds for detrimental soil conditions.

Pre-activity surveys for the Wallowa-Whitman National Forest documented that all but one proposed timber sale project areas had some units that exceeded the threshold (exact statistics were not disclosed). The lone exception was the Reservoir Timber Sale where post project monitoring found that all soil standards had been met. Subsoiling on one project was found to be enhancing the soil recovery process (unpublished).

### Timber Harvest Effects

The trends in existing conditions are described for two eras of timber harvest practices. The first timber harvest era is pre-1990. The second timber harvest era is 1990 to present. Prior to 1990, the national forests offered timber sales on large tracts of land where heavy logging occurred from approximately the 1920s to the late 1980s. Timber harvest activities included the harvesting and removal of large diameter trees (often old growth ponderosa pine) with ground-based, rubber-tired tractors and skidders, and preparation and sanitization for re-planting by tractor piling, brush piling, and burning of slash residue piles. Further site preparation would often include post-harvest broadcast burning.

The second timber harvest era is a result of the National Forest Management Act (NFMA) of 1976, which included policies and guidelines directing that National Forest System lands be managed to maintain their productive potential. Compliance with the new policies was to be shown through implementation, effectiveness, and validation (research) monitoring results. The NFMA resulted in a dramatic change in design criteria and the types of constraints or mitigations, technology, and restoration activities needed to comply with revised Forest Service direction and policies (USDA Forest Service 1990), including:

- Increased skid trail and road spacing
- Reduced equipment ground passes
- Use of low ground pressure, ground-based machinery, including mechanical processers and loaders/forwarders
- Change in season of operation to limit timber harvest activities to when soils are either dry or frozen
- Use of whole-tree yarding
- Hand piling and burning of small piles

- Seasonal prescribed burning to reduce disturbance from slash reduction and site prep
- Implementation of subsoiling to ameliorate soil compaction effects for improvement of soil productivity, stand regeneration, and hydrologic processes

In the late 1900s, timber managers throughout the Blue Mountains were also faced with increased forest health issues and wildfire concerns (Everett et al. 1994). The resultant management of large acreages of overstocked stands required the use of efficient, less costly, low ground pressure mechanized harvest and yarding equipment to thin overstocked stands, harvest timber and the use of prescribed fire to reduce fuel loads and fire hazard. Research and local soil monitoring summarized in the following pages indicate a corresponding overall reduction in adverse soil impacts to the soils during the second era (USDA Forest Service 2001).

From the late 1920s to approximately the early 1990s, management focused on regeneration harvest activities and or/selection harvest activities to remove large diameter trees with high ground pressure, ground-based equipment and intense site sanitation and seedbed preparation techniques. Research and monitoring surveys estimated the amount of detrimental soil conditions throughout the Blue Mountains national forests to range from approximately 17 percent to greater than 55 percent of an individual activity area. These values exceed or come close to the threshold of no more than 20 percent of an activity area resulting in detrimental soil disturbance specified by regional guidance and revised forest plans (USDA Forest Service 1998). Harkenrider (1979) found that a clearcut lodgepole pine stand within the La Grande Ranger District that was harvested with a feller-buncher, yarded to a landing with a rubber-tired skidder, and slash dozer-piled and burned resulted in approximately 55 percent of the area's soils detrimentally compacted and 12 percent moderately compacted.

Sullivan (1988) found that 15 of 24 timber harvest units had post activity soil impacts that exceeded the regional standard of 20 percent of the area, and another 5 units had soil impacts on more than 15 percent of their area.

In the early 1990s, harvest activities focused on use of new technologies and project design criteria to comply with revised management direction and policies (USDA Forest Service 1990). Commonly used design criteria included designated trail spacing, low ground pressure machinery, mechanical harvesters, processers and loaders/forwarders, season of operation, operating over frozen ground, snow and slash, hand piling of slash, and restoration (including subsoiling). After approximately 1990, research and local soil monitoring results (USDA Forest Service 2001) indicate that the use of updated technology corresponds to an overall reduction in areal extent of detrimental soil disturbance and often results in compliance with the standard of no more than 20 percent of an activity area's soils being detrimentally impacted (USDA Forest Service 1998).

Published data for detrimental soil compaction from timber harvest activities range from approximately 5 to 30 percent of an area. Areas in the high end of the range were generally harvested in the mid to late 1990s, while areas in the low end of the range were generally harvested from the late 1990s to early 2000s. Less detrimental impacts are generally attributed to the use of multiple mitigation measures to limit soil disturbance. The variation is generally the result in changes in project design criteria, including the amount of timber removed and type equipment used. Similar soil disturbance characteristics can occur in areas of thinning harvests, clearcuts, and partial cuttings if ground-based equipment is used, although traffic patterns are likely to be less concentrated in partial cut activities, which results in less soil impacts overall (Page-Dumroese et al. 2009, Miller et al. 2010, Chanasyk et al. 2003). This trend is indicated in the research findings, where lower areal extent of detrimental soil conditions is generally associated with thinning operations (McIver et al. 2003, and McIver 1998), operating over snow (Craigg and Howes 2007), or use of a skyline logging system (Allen et al. 1999).

Allen and Adams (1997) found that thinning of second-growth Douglas-fir with a skyline logging system resulted in only 2 percent of the area soil being detrimentally disturbed.

McIver (1998) found that 6 of 7 thinning units on the Wallowa Whitman National Forest had total disturbance levels less than 10 percent. Unit 7, yarded using a rubber-tired skidder, had the greatest amount of detrimental soil disturbance. McIver (1998) also found that mechanized cut-to-length harvesters tended to result in displacement, rather than compaction, as the primary form of detrimental soil disturbance.

Allen et al. (1999) found that utilizing a cut to length harvester and skidding operation for partial cuttings in western and northeastern Oregon resulted in detrimental soil compaction on 21 percent of the area. Skyline yarding resulted in detrimental soil disturbance (compaction and displacement) on about 6 to 7 percent of the harvested area. Results indicated that skyline yarding created more displacement than compaction. After one year, Allen et al. (1999) found that there was no off-unit sediment transport from these areas, with the exception of very limited amounts from skyline corridors.

McIver et al. (2003) found that uneven-aged and intermediate treatment activities using a cut-to-length forwarder system resulted in detrimental soil conditions in no more than eight percent of an activity area.

Craigg and Howes (2007) found that a thinning project using a low ground-pressure Timberjack cut-to-length harvester and forwarder and a variety of mitigation measures designed to reduce soil impacts, including, operating on frozen ground, snow and slash, designated trail spacing, and hand piling of slash, resulted in detrimental soil conditions on approximately three percent of the activity area.

Bliss (2006) assessed several published and non-published detrimental soil conditions surveys for the Wallow Whitman National Forest and compiled a summary of findings. Adjustments in treatment made after the 1990 forest plan was implemented resulted in a reduction in detrimental impacts to soils. In general, post harvest ground disturbance ranged from approximately 10 to 20 percent, with a range of 6 to 12 percent of new detrimental soil conditions. The amount of new disturbance was found to vary depending on the amount of new skid trails created and used.

Table 119 displays the range (in acres) of detrimental soil conditions on the landscape as a result of historic timber harvest activities. The range (in acres) of detrimental soil conditions from ground-based timber harvest activities was determined by calculating 5 percent and 55 percent of the acres of timber harvest, the lowest published detrimental soil conditions (Bliss 2006, Craigg and Howes 2007) and the highest published detrimental soil conditions (Harkenrider 1979) respectively. Five percent was added to the result to account for detrimental impacts from constructing National Forest System roads and temporary roads.

The range (in acres) of detrimental soil conditions on the landscape as a result of historic aerial timber harvest activities was determined by calculating 2 percent and 6 percent of the acres of aerial timber harvest, the lowest published detrimental soil conditions (Allen and Adams 1997) and the highest published detrimental soil conditions (Bliss 2006) respectively. Again, five percent was added to the result to account for detrimental impacts from constructing National Forest System roads and temporary roads.

The ranges (in acres) of detrimental soil conditions for both ground-based and aerial harvest systems include impacts associated with site preparation activities and post harvest treatments, including post harvest slash treatment. The acres of past timber harvest activities were calculated using GIS data. Since some areas have been harvested more than once, acres for these areas will be included more than once in the totals displayed in table 119.

Ground-based timber activities have generally been implemented on slopes with less than 30 percent rise because of increased risk of erosion when ground cover is removed or soils are disturbed. In some cases, ground-based harvesting may have occurred on slopes with greater than 30 percent rise. Sky line or aerial timber activities have generally been implemented on slopes with greater than 30 percent rise and in some areas where protection of soils and other resources is a priority (e.g., post wildfire salvage operations).

**Table 119. Estimated acres of detrimental soil conditions (DSCs) for ground-based and cable and aerial logging systems for each national forest**

| National Forest | Ground-based Timber Harvest Activities | | Cable and Aerial Timber Harvest Activities | | Total Timber Harvest Activities | |
|---|---|---|---|---|---|---|
| | Harvest | Range of DSCs | Harvest | Range of DSCs | Harvest | Range of DSCs |
| MAL | 407,486 | 40,748 to 244,491 | 49,347 | 3,454 to 5,428 | 456,833 | 44,202 to 249,919 |
| UMA | 185,936 | 18,593 to 111,561 | 64,654 | 4,525 to 7,111 | 250,590 | 23,118 to 118,672 |
| WAW | 300,676 | 30,067 to 180,405 | 24,846 | 1,739 to 2,733 | 325,522 | 31,806 to 183,138 |
| Totals | 894,098 | 89,408 to 536,457 | 138,847 | 9,718 to 15,272 | 1,032,945 | 99,126 to 551,729 |

## Wildland and Prescribed Fire

Wildland fires are a natural ecological process within the Blue Mountains national forests. However, high intensity fire and severe burns over large portions of landscapes can occur, which can cause an array of ecosystem responses, including vegetation dynamics: regeneration, compositional changes, mortality, diversity, faunal community dynamics, and changes in soil productivity and nutrient and carbon cycling. Impacts to watersheds include increased soil erosion, sedimentation, flooding, landslides, and debris flows (Keeley 2009). Understanding the effects of fire throughout the plan area is difficult. The variation in natural potential vegetation and the variation in the natural historic fire regime include community composition and structure, fuel quality and quantity, climate, soil properties, topography, the long period of fire exclusion since Euro-American settlement and fire suppression, post fire restoration, and post fire timber salvage activities. The extent, intensity, fire or burn severity, and resulting impacts have varied widely. An increase in wildland fire size and quantity has been documented since the early 1960s, with greater increases documented starting in the 1980s. Significant increases in wildfire ignitions and severity have been documented in the 2000s.

Wildland fires or prescribed fires characteristic of the historic fire regime with low or moderate burn severities can improve soil fertility by facilitating periodic release of nutrients (USDA Forest Service 2006). However, high intensity, long duration fires that result in high burn severity can have significant impacts on ecosystem processes due to the total consumption of the forest floor and the loss of coarse woody debris that serve as nutrient reserves for long term storage of forest nutrients necessary for sustaining plant growth, biological activity (Harvey et al. 1987), and soil erosion, especially on steep slopes. Loss of the forest floor effective ground cover and coarse woody debris has been related to an increase in sheet, rill, and gully erosion and reduced infiltration rates leading to increased rates of erosion, sedimentation and flooding (Robichaud and

Brown 1999). The predominant process is the reduction in canopy cover and effective ground cover, and the subsequent increase in mineral soil exposed to raindrop splash and surface sealing. Increased erosion as a result of burning is also influenced by the fire intensity and burn severity. Other factors for increased erosion include creation of water repellant soil (hydrophobic) and the resultant increased runoff and overland flow. Coarse textured soils are more prone to becoming hydrophobic following a wildfire than fine textured soils. Hydrophobic compounds are slightly water soluble; therefore, hydrophobicity is broken up or washed away after the first one or two rain events or after a winter of slow wetting and freeze-thaw (Neary et al. 2005).

Since about 2000, surveys have been conducted within the Wallowa Whitman National Forest to estimate the amount of coarse woody debris following fires and salvage activities. These surveys indicated that the units generally meet or exceed the minimum recommended amounts of coarse woody debris. Recruitment of fine organic debris from needle cast and limbs both post fire and after salvage activities has contributed to sustaining the long-term nutrient stores throughout the plan area (Schnepf et al. 2009).

Salvage logging following wildfires was identified as a cause of erosion affecting stream sedimentation and productivity in central Washington (Klock 1975). Published studies reported that the implementation of resource standards and guidelines for site protection at salvage logging sites within the Wenatchee National Forest in central Washington (Klock 1975) and within the Malheur National Forest in the Blue Mountains (Mciver and McNeil 2006) were the most important factors that influenced soil erosion. In addition, ground-based yarding systems resulted in far more soil disturbance than aerial systems (Klock 1975).

Assessing or quantifying soil conditions after wildland fire and prescribed fire is difficult due to the many variables affecting ecosystem response to fire. Johnson (1998) compared reported burn intensity of fires in the Blue Mountains from 1986 through 1994 to estimates of burn severity of historical fires in the region by Agee (1996) and concluded the burn severity is likely higher now than in the past, but varies geographically within the Blue Mountains.

The overall effect of wildland and prescribed fire on above-ground organic matter (dead and down material) and subsequent soil fertility, soil carbon, and nitrogen changes are difficult to quantify on a landscape scale (Johnson and Curtis 2000). In an extensive literature review of forest management effects (including fire) on soil carbon and nitrogen, Johnson and Curtis (2000) found that the effects of fire on soil carbon and nitrogen are quite variable and difficult to quantify. They also found time after a fire event to be a significant effect, with an increase (compared to study plots) in both soil carbon and nitrogen documented after approximately 10 years. In addition, they documented decreases in soil carbon following prescribed fire and increases in soil carbon and nitrogen following wildfire. The increases following wildfire was attributed to the sequestration of charcoal and recalcitrant and hydrophobic organic matter, as well as establishment of nitrogen fixing plants following wildfires. Fire suppression activities (e.g., fireline and fuel break construction and construction of fire camps and aircraft landing zones) tend to compact or displace surface soil and have had indirect impacts on long term soil productivity and hydrologic function throughout the plan area. It is assumed that within the plan area, high wildland fire severity and fire suppression have caused an array of ecosystem responses, including vegetation changes, increased erosion, and reduced organic materials and coarse woody debris amounts to less than the optimum levels needed to sustain soil productivity and soil health (Kerrick et al. 1989).

### Livestock Grazing

Commercial livestock grazing began in the late 1800s with Euro-American settlement. From the late 1800s to mid 1900s, livestock grazing management was very limited and generally involved continuous, year-round grazing. As a result, much of grazing lands in the Blue Mountains national forests were severely impacted by overgrazing. These impacts are still evident on the landscape (Quigley et al. 1997). Soil disturbances caused by historic overgrazing generally consist of compaction, displacement, alteration of vegetation community (ground cover diversity and composition), and invasion by non-native vegetation.

Soil disturbance and the degree of impact from livestock grazing activities throughout the plan area is variable. It has been influenced by many factors, including the type and intensity of historic and current livestock grazing (i.e., season of use, livestock use patterns, degree of disturbance, and type of livestock: cattle, sheep, horses, or goats), soil type (i.e., soil depth and volcanic ash content), compaction or displacement potential of the soil, slope gradient, aspect, and other inherent and dynamic properties (Heady 1975).

Overall, the greatest concentration of detrimental soil disturbance and related decrease in soil quality is associated with historic and current high use commercial livestock grazing areas. These areas generally include winter feeding grounds, holding pastures, animal trails (both in the uplands and along fence lines), historic homestead sites, historic irrigation canals, abandoned cropland (potentially seeded to pasture), roads and developed motor vehicle trails, springs and developed water sites, salting areas, and loafing areas associated with capable grazing lands (Platts 1991). Capable grazing lands are associated with land type associations with slopes with less than 60 percent rise, considered capable for sheep grazing, and slopes with less than 45 percent rise, considered capable for cattle grazing. Capable grazing lands also have a tree canopy and/or unpalatable shrub canopy of less than 60 percent and/or have the inherent capacity to produce more than 200 pounds of forage per acre (e.g., limited amounts of rock outcrops or nutrient poor or shallow soils).

Sites associated with land type associations determined to have poor suitability for grazing (i.e., greater than 40 percent slope rise for cattle, greater than 60 percent slope rise for sheep, and low forage production rates) are considered to have less resistance and decreased resiliency to grazing effects on the soil and vegetation components (USDA Forest Service 2006). However, due to the severity of topographic features, including steepness of terrain and high amount of rock outcrops limiting access to slopes with greater than 60 percent rise, these areas are generally grazed incidentally and used lightly and are assumed to have little to no detrimental soil impacts associated with livestock grazing and management.

### Existing Soil Conditions at Roads and Landings

Roads and landings are considered part of the permanent national forest management infrastructure and transportation system and are estimated to be 5 percent of the managed acres within a national forest. These acres are considered to be in a permanent detrimental soil condition.

## Environmental Consequences – Soils

Management activities can result in direct and indirect effects on soil resources, which may include alterations to physical, chemical, and/or biological properties. Soil disturbance is defined as any Forest Service management practice that results in soil compaction, puddling, displacement, severe burning, or the loss of ground cover (USDA Forest Service 1990). Puddling, severe burning, and loss of ground cover are not very common, while compaction (increase in soil bulk density with a decrease in soil porosity) and displacement are common effects of management activities that can negatively affect soil productivity. Indirect effects may include erosion, mass wasting, and changes in water table, soil biology, organic detritus recruitment, and fertility, such as the fertilization effects of ash after a low intensity fire.

1990 forest plan guidelines state that at least 80 percent of an activity area is to be maintained in a condition of acceptable soil productivity potential. Forest Service Manual and Handbook (FSM and FSH) provide national management direction for soils that defines soil productivity and components of soil productivity, establishes guidance for measuring soil productivity, and establishes thresholds to assist in project planning. Numerous best management practices (BMPs) provide guidance for managing National Forest System lands to maintain or improve soil quality and to avoid permanently impairing the productivity of the land.

This Soils section of the DEIS is not a spatial analysis of effects on soils. A forest plan is a programmatic document and no specific management actions are proposed. Each alternative would comply with laws, regulations, and policies in place to ensure maintaining soil quality and meeting minimum soil productivity standards. Additionally, the maintenance of soil function is a critical component of the objectives and desired conditions developed for each of the alternatives for forest plan revision.

## Alternative A (No-action Alternative)

Current direction for managing soils for all national forests is documented in the Forest Service Manual and Handbook (FSM and FSH). This direction, along with regional supplements, requires that detrimental soil conditions are not exceeded on more than 20 percent of a project activity area, including roads.

## Alternatives B, C, D, E, and F

All alternatives are in compliance with soil management direction in FSM 2550 Soil Management along with any amendments and regional supplements.

The following standards and guidelines are included in all alternatives for the protection of soils: FIRE-3, FOR-7, FOR-9, RMA-FIRE-11 (see appendix A). The following desired condition is proposed for all alternatives:

> The productive potential of forest and range soils is maintained at levels that contribute to long-term sustainability of ecosystems considering the range of possible climate change scenarios. Soil physical and chemical properties (texture, porosity, strength, coarse fragment content, and fertility) and organic matter (surface woody debris, humus) are at levels that maintain soil productive potential and hydrologic function (infiltration, percolation, and runoff). Surface soil erosion and sediment deposition rates are within the natural range of variability for each biophysical setting.

Upon implementation, each alternative would lead to a unique combination of activities designed to meet land management objectives. The indicator used to analyze environmental consequences to soils is the potential acres of detrimental soil conditions associated with proposed acres of ground-disturbing activities.

### *Timber, Wildland Fire, and Fuels Reductions*

Disturbance to forest soils can result from the use of heavy equipment during timber harvest operations, including harvesting, yarding, sorting at landings, site preparation, slash treatment, and restoration activities. Soil disturbance caused by logging can have detrimental or negative effects on soil quality and site productivity. The intent of forest plan standards and guidelines is to minimize the extent (area) of detrimental levels of soil disturbance. Specifically, the total area exceeding criteria for detrimental disturbance in any harvest unit should be no more than 20 percent.

Table 120 displays the projected annual acres of timber harvest and fuels reduction treatments that have the potential to impact soils for each alternative for each national forest.

**Table 120. Acres of ground-disturbing activities associated with timber harvest and fuels reduction treatments projected annually for each alternative for each national forest**

| Activity | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| **Malheur** | | | | | | |
| Even-aged regeneration harvest* | 150 | 1,500 | 800 | 3,300 | 2,900 | 1,800 |
| Uneven-aged and intermediate harvest | 6,950 | 5,600 | 2,600 | 17,200 | 9,600 | 6,500 |
| **Timber harvest totals** | **7,100** | **7,100** | **3,400** | **20,500** | **12,500** | **8,300** |
| Planting | 100 | 700 | 400 | 1,600 | 1,400 | 900 |
| Precommercial thinning | 1,400 | 1,400 | 1,000 | 3,000 | 1,400 | 1,400 |
| Burning and mechanical treatment of fuels ** | 16,600 | 16,600 | 12,900 | 20,500 | 22,000 | 17,800 |
| **Umatilla** | | | | | | |
| Even-aged regeneration harvest* | 260 | 1,200 | 500 | 2,600 | 2,400 | 1,500 |
| Uneven-aged and intermediate harvest | 4,940 | 4,000 | 1,800 | 13,000 | 8,200 | 4,900 |
| **Timber harvest totals** | **5,200** | **5,200** | **2,300** | **15,600** | **10,600** | **6,400** |
| Planting | 150 | 600 | 200 | 1,300 | 1,200 | 700 |
| Precommercial thinning | 1,600 | 1,600 | 1,500 | 3,200 | 1,600 | 1,600 |
| Burning and mechanical treatment of fuels ** | 19,100 | 19,100 | 12,300 | 16,000 | 20,600 | 16,400 |
| **Wallowa-Whitman** | | | | | | |
| Even-aged regeneration harvest* | 90 | 1,000 | 500 | 2,500 | 2,000 | 1,400 |
| Uneven-aged and intermediate harvest | 4,410 | 3,550 | 1,550 | 13,750 | 7,350 | 4,650 |
| **Timber harvest totals** | **4,500** | **4,550** | **2,050** | **16,250** | **9,350** | **6,050** |
| Planting | 50 | 500 | 200 | 1,200 | 1,000 | 700 |
| Precommercial thinning | 2,600 | 2,600 | 1,700 | 5,200 | 2,600 | 2,600 |
| Burning and mechanical treatment of fuels** | 15,000 | 15,000 | 12,550 | 17,000 | 19,850 | 16,550 |

* Split assumption for timber harvest is 90 percent ground-based logging system and 10 percent cable logging system.

** Mechanical treatment of fuels is expected to occur on more than 25 percent of the acres listed for this category.

### *Even-aged Regeneration Harvest*

Even-aged regeneration harvest can include clearcut, shelterwood, and seed tree prescriptions. These prescriptions are generally followed by additional activities (fuels reductions or subsoiling) and may include planting. Even-aged regeneration harvest and yarding can be accomplished using either ground-based logging equipment, cable/aerial logging systems, or a combination of both. Ground-based equipment is generally limited to slopes with less than 30 percent rise (USDA Forest Service 1990). A cable logging system is generally used on slopes with greater than 30 percent rise or on sites where protection of soils or other resources is a priority (e.g., post-fire harvest). For analysis purposes, even-aged management activities using ground-based equipment are assumed to result in approximately 10 to 20 percent ground displaced and disturbed soils and no more than 15 percent of the area in new detrimental soil conditions for any unit. The majority of new detrimental soil conditions are assumed to be soil compaction.

Even-aged management activities using a cable logging system are assumed to result in no more than 6 percent of the area in new detrimental soil conditions for any unit. The majority of detrimental soil conditions is assumed to be soil displacement (Han 2007, Han 2006, Drews et al. 2000, McIver and Starr 2001). These estimates for both ground-based and cable logging systems take into account disturbances from other associated timber harvest activities, including landings and fuels reductions. Landings are estimated to account for approximately 1 to 2 percent of detrimental soil conditions in a harvest unit area, and fuels reductions activities are estimated to account for approximately 1 to 4 percent of detrimental soil conditions (Bliss 2003a, Farren 2006a and 2006b). Detrimental soil conditions associated with roads are not included in new disturbances due to Forest Service direction to use existing system roads and to minimize new road construction.

### *Uneven-aged and Intermediate Harvest*

Uneven-aged and intermediate harvest generally consists of single tree selection, small group selection, and intermediate thinning activities designed to maintain or enhance uneven-aged stand structure and reduce fire risk. These harvest activities are generally implemented using ground-based equipment. Magnitude, extent, and duration of effects on soils are expected to be considerably less than those expected for even-aged harvest. This is mainly due to the ability to use smaller, lighter equipment and the harvest of less volume of material, which, when yarded, results in fewer equipment passes.

Based on recent monitoring and research results, uneven-aged and intermediate treatment activities using ground-based equipment can be expected to result in no more than 8 percent of the area in new detrimental soil conditions (McIver et al. 2003, Craigg and Howes 2007). The majority of new detrimental soil conditions is expected to be soil compaction. This estimate takes into account new detrimental soil conditions from associated landings and post treatment fuel reduction activities (Bliss 2003a, Farren 2006a and 2006b). Uneven-aged and intermediate harvest can result in more stand entries than even-aged harvest treatments. Detrimental soil conditions associated with roads are not included in new disturbances due to Forest Service direction to use existing system roads and to minimize new road construction.

### *Precommercial Thinning and Mechanical Fuels Treatments*

Pre-commercial thinning and mechanical fuels treatment activities may be accomplished by hand or with ground-based mechanical thinning equipment and/or grapple-piling equipment depending upon site specific design criteria, desired condition, and other resource objectives. Fuels treatments may include some combination of thinning and piling, thinning slash by hand or machine, burning or chipping, broad cast prescribed burning, mechanical crushing of fuels, or removal of small diameter biomass for commercial use. Due to the growing commercial value of biomass for fuel, the removal of small diameter logs from the treatment unit is more likely than in the recent past.

For mechanical crushing of fuels, grapple or mastication heads are mounted on small-body excavators with wide tracks similar to those used with mechanical harvesters. These machines have relatively low ground pressure and can work on top of downed logs and existing or thinning-created slash. However, this equipment has been found to produce additional compaction on operation trails and some soil displacement while turning (Bennett 2011, Farren 2006a, and Bliss 2006). Pre-commercial thinning and mechanical fuels treatment activities using ground-based equipment can be expected to result in no more than approximately 5 percent of an activity area in new detrimental soil conditions. This estimate takes into account new detrimental soil conditions associated with post thinning fuels treatments and associated landings from biomass removal (Bliss 2003a and Farren 2006a and 2006b). Detrimental soil disturbance is commonly well distributed across activity areas, and ground cover is generally minimally disturbed. Detrimental soil conditions associated with roads are not included in new disturbances due to Forest Service direction to use existing system roads and to minimize new road construction.

### *Activities with Few or No Predicted Effects on Soils*

Some activities generate few, if any, measurable effects on soils. Planting typically is accomplished using hand-held tools and bare root or containerized seedlings. There generally is little or no soil disturbance associated with this activity, with the exception of preparing the actual planting sites with hand tools in order to achieve better seedling establishment. The degree and extent of soil disturbance associated with planting does not measurably reduce site productivity or generate soil erosion. Knowledge of the soils present at planting sites, seasonal and diurnal temperature and moisture fluctuations, soil moisture release characteristics, and coarse fragment content are all important factors considered when preparing for successful planting projects.

Pre-commercial thinning by hand (i.e., personnel using chainsaws or other equipment) generates little or no measurable soil disturbance. Thinning slash, whether left in place or hand-piled, remains largely within the unit. Burning, if prescribed, often occurs one to three years after thinning, which allows needles to fall from branches and reduce fire risk to residual trees. Piles are normally small and fire intensity from pile burning rarely produces severe soil burn effects. Detrimental soil conditions resulting from burning of hand piled fuels is estimated to be no greater than 1 percent of a treatment area (Bliss 2006).

Prescribed fire can release nitrogen into the soil, initially increasing productivity. The long-term decreases in soil productivity from nutrient losses are determined by how often and how severely the soil is disturbed. Soil productivity can increase where low-severity fires take place periodically and nutrients tied up in understory vegetation and woody debris become available for residual plant uptake (Oliver and Larson 1996). Burning can also favor fire-resistant plants, such as grasses, and some pioneering plants, such as *Ceanothus* species, which add nutrients to the soil (Sexton 1998).

Prescribed burning following harvest activities may create some areas of high-severity burn where fuels are concentrated and burn for a long time (residence time). Severe burn areas are typically associated with pockets of concentrated post-harvest fuel loads and areas adjacent to and under logs and stumps. Past monitoring of prescribed fire areas revealed that prescribed underburning produced severe burn soil effects on less than 4 percent of an area (Bliss 2001, Farren 2006a). However, severe burn effects from prescribed fire are not considered detrimental soil conditions, because severe burn areas are generally less than 100 square feet (USDA Forest Service 1990). Nevertheless, areas of severe soil burning are associated with decreased effective ground cover and soil surface organic matter important for water retention, soil structure, nutrient cycling, and microbial populations (Powers et al. 1990). Severe burning of soils has been associated with decreased infiltration, increased runoff, and accelerated erosion. The erosion risk may or may not be realized after prescribed burning activities depending upon the extent of severely burned soils and upon weather events. The amount of severely burned soils and ground cover reduction from prescribed burning is proportional to the acres treated by underburning.

Suppressing or eradicating populations of invasive plants is an activity that generates few if any soil disturbance concerns. Most of this activity is accomplished by hand pulling and grubbing or by applications of approved herbicides by hand or from an ATV or truck bed. Hand grubbing can create some localized soil disturbance; however, its degree and extent is usually of no concern from a soil productivity or erosion standpoint. When planning a weed control project, knowledge of soil characteristics, such as organic matter content and texture, is important in order to meet label requirements for certain herbicides. Some herbicides may reside in the soil for longer periods of time and could affect soil productivity in localized areas.

While these activities may create some amount of soil disturbance, it is anticipated that there will be few, if any, measurable adverse impacts. Some alternatives would have more acres of certain activities than others; however, it would be impossible to quantify the impacts on soils and future productive potential and thus determine that any one alternative would create more detrimental soil impacts than another. Therefore, these activities will not be considered further in the analysis of soil impacts.

### *Discussion of Risk for Activities That Generate Effects on Soils*

Fundamental to sustainable use of National Forest System lands is the ability to assess relative risk, or lack thereof, of a proposed activity at a specified location and time (Reynolds et al. 2011). This strategy recognizes that potential risk of a given action or inaction (hazard of impact and consequences of that impact) depends on numerous site specific factors and climatic conditions before and after the activity. By assessing the relative risk of incurring soil damage, an activity that best fits site-specific conditions can be prescribed and implemented. Complexity of interactions among activities, local conditions, and on- and off-site consequences must be recognized. Following is a brief description of the analysis procedure and calculations used to estimate change in detrimental soil conditions by alternative.

In evaluating the potential effects of the alternatives on soils, a comparison of the total acres that would be treated for each activity is used as a surrogate for potential detrimental soil effects. To estimate the amount of detrimental soil conditions resulting from those activities during the 10-year plan period, the number of acres of potential detrimental soil condition is calculated using the following formula: acres of activity multiplied by percent soil disturbance factor of specific treatment per year. Acres of activity by national forest and alternative on an annual basis are displayed in table 120. The soil disturbance factor for timber management activities is displayed in table 121.

**Table 121. Distribution of timber management activities between potential vegetation groups**

| Potential Vegetation Group | Distribution of Timber Management Activities |
|---|---|
| Cold forest (associated with ash cap soils) | 5-10% |
| Moist forest (associate with ash cap soils) | 10-30% |
| Dry forest (associated with low ash content soils) | 60-90% |
| Cold forest (associated with ash cap soils) | 5-10% |

The estimated amount of detrimental soil conditions is calculated assuming approximately 90 percent of the even-aged harvest treatment acres would be harvested using a ground-based logging sustem and the remainder (approximately 10 percent) with a cable logging system. Acres that would be treated are assumed to be equally distributed across MA 4A General Forest but not equally distributed across potential vegetation groups (PVGs). It is estimated that 60 to 90 percent of the timber harvest activities will take place within dry forest PVGs (see table 124). Approximately 5 to 10 percent and 10 to 30 percent would occur within the cold forest and moist forest PVGs, respectively. However, acres to be treated would be determined on a site-specific basis taking into account the need for the project and the condition of the area to be treated.

Table 122 displays the amount of detrimental soil conditions associated with timber harvest and fuels reduction activities that would occur annually for each alternative for each national forest. Table 123 displays the total acres of new detrimental soil conditions associated with timber management activities for each alternative for each national forest that would occur during the 10-year plan period. Actual impacts of each alternative on soil productivity and hydrologic properties would be evaluated at the project level and would be dependent on local soil characteristics, equipment used, time of operation, and other resource values.

**Table 122. Acres of detrimental soil conditions associated with timber harvest and fuels reduction treatments expected annually for each alternative for each national forest**

| Activity | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| **Malheur** | | | | | | |
| Even-aged regeneration harvest | 22 | 25 | 120 | 495 | 435 | 270 |
| Uneven-aged and intermediate harvest | 555 | 448 | 208 | 1,375 | 768 | 520 |
| Precommercial thinning | 70 | 70 | 50 | 150 | 70 | 70 |
| Mechanical treatment of fuels* | 206 | 206 | 125 | 250 | 250 | 212 |
| **Total estimated acres of detrimental soil conditions** | **853** | **749** | **503** | **2,270** | **1,523** | **1,072** |
| **Umatilla** | | | | | | |
| Even-aged regeneration harvest | 40 | 180 | 75 | 391 | 360 | 225 |
| Uneven-aged and intermediate harvest | 395 | 320 | 145 | 1,040 | 658 | 252 |
| Precommercial thinning | 80 | 80 | 75 | 160 | 80 | 80 |
| Mechanical treatment of fuels* | 194 | 194 | 150 | 200 | 250 | 212 |
| **Total estimated acres of detrimental soil conditions** | **709** | **774** | **445** | **1,791** | **1,348** | **769** |
| **Wallowa-Whitman** | | | | | | |
| Even-aged regeneration harvest | 14 | 150 | 75 | 376 | 300 | 210 |
| Uneven-aged and intermediate harvest | 342 | 285 | 125 | 1,100 | 588 | 372 |
| Precommercial thinning | 130 | 130 | 85 | 260 | 130 | 130 |
| Mechanical treatment of fuels* | 188 | 188 | 88 | 212 | 250 | 200 |
| **Total estimated acres ofdetrimental soil conditions** | **674** | **753** | **373** | **1,948** | **1,268** | **912** |

* The actual amount of detrimental soil conditions that would result from mechanical fuel treatments for each alternative increases as fuel loads increase. It is assumed that any fuel treatments utilizing fire will be prescribed fire and that any soil damage would be inconsequential or not measurable; therefore, no acres of detrimental soil conditions would be associated with prescribed fire.

Table 123 displays the estimated acres of new detrimental soil conditions associated with timber management activities for the 10-year plan period for each alternative for each national forest. All alternatives would result in some degree and extent of detrimental soil conditions. Each alternative would comply with the laws, regulations, and policies in place to ensure maintaining soil quality and meeting minimum soil productivity standards. The order of impact from highest to lowest would be alternative D followed by E, F, B, C, and A.

**Table 123. Acres of detrimental soil conditions projected from timber management activities for each alternative for each national forest during the first decade of the plan period**

| National Forest | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| MAL | 8,530 | 7,490 | 5,030 | 22,700 | 15,230 | 10,720 |
| UMA | 7,090 | 7,740 | 4,450 | 17,910 | 13,480 | 7,690 |
| WAW | 6,740 | 7,530 | 3,730 | 19,480 | 12,680 | 9,120 |

In summary, the acres of new detrimental soil conditions anticipated from implementation of the alternatives are based on best available science and is calculated using recent local monitoring data. Timber management activities with contemporary harvest systems (e.g., fuels reductions and timber harvest) can generally meet minimal detrimental soil condition standards. However, that actual amount of new detrimental soil disturbance would vary by degree, extent, duration, and distribution or pattern depending on highly variable soil and site characteristics (Jurgensen et al 1997) and on site-specific project design. In many instances, less detrimental soil disturbance would be achieved through use of state-of-the-art timber harvesting and processing equipment and other project design features or mitigation measures, such as avoidance of unsuitable or high risk areas. Furthermore, rehabilitation work before final completion of operations can further reduce impacts from timber harvest activities and related long-term effects to soils.

An indication of the relative magnitude of effects of activities on soil productivity between alternatives can be obtained by comparing acres of treatment occurring in different forest types (dry, moist, and cold potential vegetation groups), along with differences in inherent soil productivity and operability limitations.

**Table 124. Distribution of timber management activities between potential vegetation groups**

| Potential Vegetation Group | Distribution of Timber Management Activities |
|---|---|
| Cold forest (associated with ash cap soils) | 5-10% |
| Moist forest (associate with ash cap soils) | 10-30% |
| Dry forest (associated with low ash content soils) | 60-90% |

When activities occur in areas with low inherent soil productivity (e.g., dry, shallow, and rocky soils) or and severe limitations to operability of ground-based equipment (e.g., thick ash capped soils with high risk of compaction), it is likely that potential soil impacts will be greater without site-specific design criteria to offset the extent, degree, and duration of soil impacts. Design criteria may include implementation of mitigation measures, such as the use of existing skid trails and wide trail spacing for shallow rocky soils or winter logging on high ash content soils. Soil impacts can also be further offset with the implementation of restoration activities, such as subsoiling. Site-specific inherent properties and limitations would be considered when developing specific project objectives and design features. Even though the potential for adverse effects on soils may be high, actual measured effects may be lower than expected and within an acceptable range if the project is carefully designed and implemented.

### *Roads*

Road construction and reconstruction can have large and long-lasting effects on soils and watersheds. Roads can intercept and reroute subsurface water movement down slope, which can lead to upslope and cutbank failures and sediment deposition into drainage channels and culverts. Roads intercept rainfall and channel it onto hill slopes. Road cutbanks are subject to rill erosion if not properly constructed and stabilized

Roads also remove areas from the productive land base. From a soil productivity standpoint, they are completely non-productive. Roads that are components of the permanent transportation system are not considered a soil productivity concern unless they are to be returned to the productive land base.

Disturbance caused by road construction activities can also reduce soil productivity and hydrologic function and can make up large percentages of activity areas (temporary roads) and watersheds (permanent roads). Analysis of environmental consequences of timber harvest activities on soils includes the assumption that approximately 5 percent of an activity area is comprised of detrimental soil conditions associated with permanent and temporary roads.

Road construction and maintenance effects are assumed to be greatest in landtype associations with steep and/or unstable slopes and highly erodible soils. Landtype associations have been evaluated for their suitability for road construction and the limitations they present. Road effect risk ratings from low to high have been assigned for each landtype association (more information is available from the project record). Given the scale of mapping for landtype associations, some areas of difficult road construction and high potential for detrimental soil effects may be encountered in landtype associations with low risk ratings.

Effects of trail construction and off-road vehicle use can be evaluated using the same factors.

Little, if any, future road construction is likely for any of the alternatives. Alternatives B, C, E, and F include objectives for decommissioning roads, although at low levels. This would return those roads into productive soils over time. No road construction effects on soils are expected for any of the alternatives.

### *Livestock Grazing*

Like timber management activities, livestock grazing (as well as concentrations of herbivorous wildlife species) can have significant and often detrimental effects on soils. Impacts of timber management activities are usually immediate or occur during a relatively short time period and are, for the most part, easily observable or detectable. Grazing impacts on soils are often subtle and go unnoticed unless unimpacted areas are available for comparison or repeated observations are made over time. However, there are exceptions, such as stock watering sites, salting stations, and livestock holding facilities.

As described previously, livestock grazing impacts to soils are considered as part of the grazing suitability analysis and determination (refer to the Livestock Grazing and Rangeland Vegetation section in this chapter). All alternatives include the continuation of permitted livestock grazing. Expected AUMs are displayed in table 125.

**Table 125. Permitted livestock AUMs (cattle and sheep) for each alternative for each national forest**

| National Forest | Alt. A | Alts. B, E, and F | Alt. C | Alt. D |
|---|---|---|---|---|
| MAL | 131,500 | 131,500 | 31,200 | 140,500 |
| UMA | 47,800 | 44,600 | 3,200 | 57,800 |
| WAW | 91,500 | 90,500 | 23,500 | 129,500 |

The effects of livestock grazing on soils are dependent on soil risk class (more information is available from the project record). The number of acres suitable for grazing by risk class and the percent of acres in each risk class is displayed in table 126.

**Table 126. Acres suitable for livestock grazing by risk class for each alternative for each national forest**

| National Forest | Alternative(s) | Area Suitable | Suitable Acres by risk Class (within active allotments) | | |
|---|---|---|---|---|---|
| | | | Low | Medium | High |
| MAL | A, B, E, and F | 1,280,000 | 166,000 (13%) | 1,101,000 (86%) | 10,000 (1%) |
| | C | 623,000 | 96,000 (15%) | 522,000 (84%) | 4,000 (1%) |
| | D | 1,361,000 | 168,000 (12%) | 1,182,000 (87%) | 11,000 (1%) |
| UMA | A, B, E, and F | 376,000 | 11,000 (3%) | 348,000 (92%) | 17,000 (5%) |
| | C | 33,000 | 1,000 (1%) | 31,000 (95%) | 1,000 (2%) |
| | D | 500,000 | 13,000 (2%) | 448,000 (90%) | 40,000 (8%) |
| WAW | A, B, E, and F | 464,000 | 22,000 (5%) | 425,000 (91%) | 17,000 (4%) |
| | C | 124,000 | 7,000 (6%) | 114,000 (92%) | 2,000 (2%) |
| | D | 649,000 | 25,000 (4%) | 594,000 (91%) | 30,000 (5%) |

The process for assigning risk classes for grazing included determining the overlap of land type associations with grazing suitability maps for each alternative. Each grazing suitability class was assigned a rating of low, moderate, or high (pers. comm. Steve Howes 2011). rating of low risk to soils from grazing was given to land type associations rated with high suitability. A rating of moderate risk to soils from grazing was given to land type associations rated with low to moderate suitability. A rating of high risk to soils from grazing was given to land type associations rated unsuitable for grazing. Unsuitable grazing lands generally included land type associations associated with steep slopes, very shallow and rocky soils, and/or sites producing less than 200 pounds of forage annually.

Alternative D would have the most acres suitable for livestock grazing and alternative C the least. Alternative D would also have the most high risk class acres suitable for livestock grazing and alternative C the least. The Malheur National Forest would have one percent or less of suitable acres in the high risk class for all alternatives. The Umatilla National Forest would vary from just more than two percent of suitable acres in the high risk class for alternative C to about eight percent for alternative D. The Wallowa-Whitman National Forest would vary from about two percent of suitable acres in the high risk class for alternative C to just under five percent for alternative D.

These ratings tend to align with the Stringham et al. (2003) indicators of rangeland health (IIRH) assessments that areas with low to moderate suitability tended to have lower resilience and resistance to grazing impacts (i.e., at a higher risk from grazing). For example, IIRH assessments generally indicated that, dry non-forested and dry forested sites tended to express slight to moderate departure for soil and site stability and moderate to extreme departure for biotic integrity. Dry non-forested and dry forested sites are generally considered to have low or moderate grazing suitability ratings. Impacts to overall rangeland health of less suitable lands tends to be expressed by greater departures in biotic integrity than soil quality attributes for the same site. It is assumed that this is due to differences in resistance and resiliency characteristics between these two ecological processes (Stringham et al. 2003).

Assessment of the areal extent of detrimental soil conditions for the plan area and even high use areas is difficult due to the scale of grazing lands and the dynamic nature of management strategies. Livestock grazing effects on soils will generally be concentrated in areas most heavily used by livestock, including corrals, trails, around salting sites, and at water developments and other water sources.

### *Recreation*

Recreation activities effects on soils are related primarily to roads. Dispersed campsites may have compaction and displacement. Locations that are very popular and constantly occupied during the summer and fall, and where adjacent to water, would be expected to have the most impacts.

The effects from recreation for any alternative are not expected to be significant. Off-road vehicle use, access to dispersed campsites, and concentrated use near water can impact soils (Eckert et al. 1979 and Lei 2007).

### *Soil Restoration*

Although protection of soils from detrimental disturbance is a primary goal of management activities, sometimes, especially where historic land use practices resulted in a high degree or extent of detrimental soil conditions, restoration of soils is needed in order to restore physical, chemical, and biological properties. In these cases, restoration of soils is an important aspect of forest and rangeland management.

Soil and watershed restoration objectives are similar for each alternative. However, each alternative differs in the amount of land that would receive restoration treatments. Predominant objectives for improved soil and watershed function include improving soil quality and hydrologic function in areas of detrimental soil disturbance, reducing road-related sedimentation by reducing road density and hydrologic connectivity of the road system, and improvement of forest vegetative conditions.

There are numerous soil restoration opportunities available as mitigations to offset impacts of management activities, in addition to restoration to reduce existing detrimental soil conditions. Examples include subsoiling to reduce soil compaction associated with roadbeds, skid trails, and landings; road decommissioning and obliteration; biochar; biosolids and other organic matter additions; seeding with native vegetation; use of biological organisms and nitrogen fixing shrubs and trees to help restore nutrient cycling processes on degraded sites; and implementation of soil erosion control measures. Restoration effectiveness in reducing detrimental soil conditions and improving soil function is highly variable. Selection of restoration treatment depends on the purpose and objective selected for the site-specific area. The purpose of soil restoration often is to improve dynamic properties to aid natural soil functions in the restoration process over time (e.g., improved infiltration and water holding capacity of soils, vegetation and root growth, organic matter accumulation, and fertility).

Approximately 80 percent of road-related sediment is coming from approximately 20 percent of the roads. Reduction of road related sediment may include various levels of road decommissioning (e.g., pulling carsonite signs, water barring, barrier construction, additions of woody material and other organic matter additions, reseeding, and culvert removal) and obliteration (e.g., subsoiling and recontouring). The actual method used to reduce road-related sediment would be determined at the site–specific, project level.

Restoration of soil chemical and biological properties specifically addresses nutrient cycling and availability of soil nutrients and moisture to aid plant growth. Appropriate soil restoration would include fertilization or the addition of organic material. Fertilization rarely occurs on National Forest System lands due to the length of rotation and the efforts to reserve organic material onsite. When organic material is lost due to fire or displaced by heavy equipment, the quality of the soil is altered.

Removal of forest floor detritus disrupts the decomposition process and reduces the amount of available material for soil microorganisms. Losses of carbon from soils result from processes that accelerate decomposition of organic matter and convert carbon in plant residues and soil organic materials into carbon dioxide. Fire itself can lead to carbon losses through the release of carbon dioxide. Tilling of soil, burning, physical removal of materials, and overgrazing are all management practices that either reduce the potential for organic residues to enter soils or increase the rates of decomposition. The processes of carbon loss from or carbon gain into the soil ecosystem can be influenced by management practices.

Any practice that enhances productivity and the return of plant residues (i.e., shoots, roots, and detritus) to soils increases soil organic matter. The type of vegetation has an effect on soil organic matter levels with higher levels of organic matter found under hardwood s than under coniferous vegetation. Fire can also contribute to soil organic carbon by converting dry plant material into charcoal, which enters the recalcitrant fraction. Soil carbon can also be enhanced by adding organic matter to the soil, e.g., manure, plant materials (mulch), biosolids, or biochar. Recent studies on the Umpqua National Forest have shown a 23 percent increase in water holding capacity of the droughty volcanic ash soils on the Diamond Lake Ranger District following an application of biochar (pers. comm. Archuleta 2011).

The use of biological organisms, including nitrogen fixing shrubs and trees, can restore nutrient cycling processes on degraded sites (e.g., landings, mining tailings, and roadbeds). These are natural components of the early seral species that establish on high burn intensity areas and can last for decades (Holofsky et al. 2011). The ecological benefits of these nitrogen fixing shrubs and trees are an important component in early successional landscapes. In highly degraded sites, or sites where forest cover has been removed for long periods of time, restoration of soil quality may require the introduction of mycorrhizael inoculants.

Restoration of soil physical properties specifically addresses the movement of roots, water, and animals through the soil. The most obvious changes in soil physical condition are related to soil compaction, which alters soil structure and soil pore space. Over time, natural processes will ameliorate soil compaction, but that may take decades. Burrowing animals and roots may serve to rehabilitate soil compaction over time. Depending on location, freeze/thaw cycles may also serve to rehabilitate soil compaction if the depth of freezing is consistent with the depth of compaction. More typically, however, ameliorating compaction requires mechanical assistance with decompaction or subsoiling equipment that breaks up the compacted layer.

Subsoiling is characteristically done to treat areas with a high degree and extent of compaction and is generally associated with skid trails, roads, and landings. Restoration of detrimental soil compaction by subsoiling serves to reduce the total area of pre-existing and new detrimental soils within activity areas (Craigg 2000, Archuleta and Baxter 2008). Subsoiling is assumed to effectively mitigate adverse compaction (Andrus and Froehlich 1983) by breaking up compacted layers; however, some percentage of the soil profile retains dense clods that are not decompacted. Subsoiling equipment, if used properly, lifts and shatters the soil profile to improve infiltration of water and aid in seed capture and create a more favorable seed bed without churning the surface soil.

Soil restoration through decompaction equipment creates conditions where natural soil functions can continue the restoration process and accelerate the physical processes that break down soil compaction over time (e.g. improved infiltration and water holding capacity of soils, vegetation and root growth, and organic matter accumulation). Subsoiling does not mitigate detrimental soil displacement. An example of this is subsoiling of road beds, which reduces compaction and increases infiltration, but soils remain detrimentally disturbed because the original topsoil is still displaced (Bliss 2006 and Powell 2005).

Subsoiling can generally be done with either a bulldozer drawn implement or with an excavator mounted implement. The excavator offers other abilities, such as grapple piling of harvest debris. Backhoe buckets have been used to effectively to decompact roadbeds, aid in seed capture, and decrease surface erosion (pers. comm. Archuleta 2011). Subsoiling can churn soil and may increase soil displacement when implemented incorrectly, used ineffectively, or used where environmental settings and conditions are improper (Archuleta and Baxter 2008 and Bliss 2006). Tines on brush blades and rock rippers rip through and displace soil but the adjacent soil is not decompacted (Bennett 2011). Subsoilers that churn soils increase rates of organic matter decomposition and increase respiration of carbon dioxide into the air. While not a concern on old roadbeds where little organic matter is found in the soil profile, it is a concern for productive forest lands. It is not appropriate to subsoil shallow or rocky soils or to subsoil on slopes with greater than 30 percent rise (Bliss 2006). To maximize fracture potential and minimize soil churning, subsoiling is recommended where soil depth is at least 20 inches and where soils are moist. Monitoring would be required to assess the actual effects of subsoiling on soil conditions.

Decommissioning a road includes many forms and intensities of treatments. The effectiveness of improving detrimental soil conditions and decreasing road-related sediment varies (Bliss 2006). These treatments include pulling carsonite signs, which is the least intensive and least effective treatment method, and water barring, barrier construction, additions of woody material and other organic matter, reseeding, culvert removal, and obliteration by subsoiling or re-contouring. Re-contouring is considered to be the most effective treatment for reducing detrimental soil conditions and is estimated to reduce approximately 80 to 90 percent of road-related detrimental soil conditions (Bliss 2006).

As displayed in table 127 through table 129, the acres of projected activities to improve soil and hydrologic function by improving forest vegetation condition are greatest for alternative D and decrease progressively in the order of alternatives E, F, B, and C. The acres of projected activities to improve soil and hydrologic function by reducing detrimental soil disturbance, reducing-road related sedimentation, implementing erosion control measures, and subsoiling are greatest for alternative C and decrease progressively in the order of alternatives B, F, E, and D.

**Table 127. Restoration activities proposed to improve soil and watershed function for each action alternative for the Malheur National Forest**

| Restoration Goals and Objectives | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|
| Improve soil and hydrologic function by:<br>• Improving forested vegetation conditions (acres) (WH1) | 4,400 acres (annually) | 2,000 acres (annually) | 20,700 acres (annually) | 7,800 acres (annually) | 5,600 acres (annually) |
| • Improving soil hydrologic function in areas of detrimental soil disturbance (acres) (WH2) | 450 acres | 800 acres | 400 acres | 600 acres | 540 acres |
| • Reducing road-related sedimentation by reducing road density and reducing hydrologic connectivity of the road system (WH3) | 10 miles<br>14-18 miles road surface treated | 15 miles<br>30-60 miles road surface treated | 0 miles<br>50-80 miles road surface treated | 10 miles<br>18-20 miles road surface treated | 14 miles<br>16-18 miles road surface treated |
| Implement erosion control and stabilization measures on unstable hillslopes. Possible activities include road obliteration and improving forested vegetation conditions. | 200-400 acres | 300-500 acres | 150-250 acres | 200-400 acres | 180-350 acres |
| Restore soil function. | 150-300 acres | 200-400 acres | 75-150 acres | 175-350 acres | 150-300 acres |

**Table 128. Restoration activities proposed to improve soil and watershed function for each action alternative for the Umatilla National Forest**

| Restoration Goals and Objectives | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|
| Improve soil and hydrologic function by:<br>• Improving forested vegetation conditions (acres) (WH1) | 2,500 acres (annually) | 1,500 acres (annually) | 12,600 acres (annually) | 6,600 acres (annually) | 3,700 acres (annually) |
| • Improving soil hydrologic function in areas of detrimental soil disturbance (acres) (WH2) | 500 acres | 900 acres | 450 acres | 750 acres | 700 acres |
| • Reducing road-related sedimentation by reducing road density and reducing hydrologic connectivity of the road system (WH3) | 10 miles<br>14-18 miles road surface treated | 15 miles<br>30-60 miles road surface treated | 0 miles<br>50-80 miles road surface treated | 10 miles<br>18-20 miles road surface treated | 10 miles<br>16-18 miles road surface treated |
| Implement erosion control and stabilization measures on unstable hillslopes. Possible activities include road obliteration and improving forested vegetation conditions. | 200-400 acres | 300-500 acres | 150-250 acres | 200-400 acres | 200-360 acres |
| Restore soil function. | 150-300 acres | 200-400 acres | 75-150 acres | 175-350 acres | 160-320 acres |

**Table 129. Restoration activities proposed to improve soil and watershed function for each action alternative for the Wallowa-Whitman National Forest**

| Restoration Goals and Objectives | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|
| Improve soil and hydrologic function by:<br>• Improving forested vegetation conditions (acres) (WH1) | 3,500 acres (annually) | 2,100 acres (annually) | 17,700 acres (annually) | 7,300 acres (annually) | 4,600 acres (annually) |
| • Improving soil hydrologic function in areas of detrimental soil disturbance (acres) (WH2) | 650 acres | 1,200 acres | 600 acres | 950 acres | 850 acres |
| • Reducing road-related sedimentation by reducing road density and reducing hydrologic connectivity of the road system (WH3) | 10 miles 14-18 miles road surface treated | 10 miles 30 miles road surface treated | 0 miles 80 miles road surface treated | 10 miles 20 miles road surface treated | 10 miles 16-18 miles road surface treated |
| Implement erosion control and stabilization measures on unstable hillslopes. Possible activities include road obliteration and improving forested vegetation conditions. | 200-400 acres | 200-400 acres | 300-500 acres | 150-250 acres | 200-400 acres |
| Restore soil function. | 150-300 acres | 150-300 acres | 200-400 acres | 75-150 acres | 175-350 acres |

Minimal additional road construction is projected for the plan area. Additionally, decommissioning and mechanical decompaction of existing authorized and unauthorized roads and areas of detrimentally compacted soils would increase, increasing acres of stable and productive soils.

Another change in physical soil quality occurs when inherent soil moisture levels are altered. There are two important examples of this occurring throughout the Blue Mountains. First, soils are considered to have been degraded in wet meadow systems and other areas that have been drained due to downcutting of streams through the area. Typically, organic rich soils form under wet soil conditions due to slow decomposition of plant material. As meadows and wetland areas are drained, this organic material is rapidly decomposed through volatilization and respiration by microorganisms. Carbon is released to the air and into the stream systems. The soil quality is severely altered causing a state transition of the type of soil found in the area. Restoration of soils in this area would require reestablishment of the groundwater regime.

Due to fire suppression, many areas of the Blue Mountain national forests have become unsustainably overstocked. During low precipitation periods when soils do not have the ability to supply moisture to support these overstocked conditions, drought stress occurs and forest health risks (e.g., insect and disease) increase. This overstocking is considered to have reduced soils quality or the inherent ability to supply water to the native vegetation communities. Along with these major changes in landscape dynamics, degradation of soils through removal of organic matter, displacement of surface soils, and soil compaction further exacerbate these conditions. Thinning of overstocked vegetation, with a focus on maintaining vegetation densities within the capacity of the soil to support productive growth, is included in the soil and watershed function restoration objectives proposed for each alternative. Restoration of these soil moisture and plant community ecological processes is also an important aspect of adapting to climate change and creating resilient landscapes.

## Cumulative Effects

Proposed actions would be designed considering balance between potential site impacts and the feasibility of operations. Previous management activities disturbed soils to varying degrees and extent, with some impacts still exceeding levels considered detrimental. Existing soil disturbance is scattered across the proposed plan area, and is concentrated on more level ground that is readily accessible primarily in the form of old skid trails and landings. Existing detrimental soil conditions often are referred to as legacy disturbance and will be factored into assessments of cumulative effects for new management actions on a site-specific level. Table 130 displays cumulative effects to detrimental soil disturbance by alternative for each national forest.

**Table 130. Cumulative range of estimated acres of detrimental soil conditions associated with timber harvest activities for each alternative for each national forest**

| National Forest | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| MAL | 52,732-258,449 | 51,692-257,409 | 49,232-254,949 | 66,902-272,619 | 59,432-265,149 | 54,922-260,639 |
| UMA | 30,208-125717 | 30,855-126,367 | 34,318-129,827 | 41,028-136,357 | 36,598-134,800 | 30,808-126,317 |
| WAW | 38,546-189,878 | 39,336-190,668 | 35,536-186,868 | 51,286-202,618 | 44,480-195,818 | 40,926-192,258 |

A certain amount of overlap occurs when activities are implemented in areas with pre-existing detrimental soil conditions (e.g, as machinery reuses some trails and landing sites, or grazing impacts occur on existing developed water sites within existing allotments). This tends to reduce the amount of added, new detrimental soil impacts. This overlap is not used to reduce estimated increases in detrimental soil conditions as the extent of this effect is too uncertain. This likely results in an overestimation of total potential detrimental soil conditions in the plan area where existing soil disturbance from previous activities occur.

## Effects of Climate Change on Soils

Climate change effects on soils in the West are not well known, but changes in the amount and timing of precipitation, snowpack, stream flow, and the frequency and severity of floods, fires, and droughts have important implications for soil carbon sequestration, soil water retention, and erosion.

Elevated carbon dioxide increases carbon supply below-ground through increased plant biomass, stimulated root growth, and root secretions in soils (Pendell et al. 2004, Ainsworth and Rogers 2007, and Ainsworth and Long 2005). Soil organic matter exerts strong influence on nutrient balance and can also influence soil water holding capacity and populations of soil organisms (Carney et al. 2007).

Increased root growth generates more carbon below ground, which can help accelerate decomposition and nutrient cycling, whereas warming is likely to increase respiration and decomposition rates. These effects have the potential to moderate one another relative to carbon emissions to the atmosphere (Kirschbaum 2000), but the effect is sensitive to changes in average temperature and changes in temperature variation (Sierra et al. 2011). Indirect effects of warming temperatures and other climate changes on soil moisture availability and nutrient supply may alter soil and plant processes in unexpected ways (Pendell et al. 2004).

Increasingly warm temperatures and associated changes in rainfall patterns, increased evaporative stress, and declines in snowpack are expected to cause a decline in soil moisture availability and possibly result in decreased soil organic matter content. Reduced soil moisture availability may in turn result in increased drought stress, making forests more susceptible to mortality from insects infestations and large, severe fires. East of the Cascade Range (i.e., the Blue Mountains), soil moisture decline and increased drought stress on forests is projected to be substantial. Increased plant growth driven by increased temperatures and carbon dioxide could also increase demands on available soil moisture. Soil texture, organic matter content, and depth is important to soil water holding capacity, and hence to an ecosystem's vulnerability to drought.

Soil erosion rates are expected to change in response to changes in climate for a variety of reasons, including the erosive power of rainfall. If rainfall amounts and intensities increase in the Blue Mountains, erosion will also increase. Other factors that could contribute to soil vulnerability, or changes in rates of water runoff and soil erosion, include:

- Changes in the amount of plant cover as ecosystem distributions shift
- Changes in amounts of litter as a result of changes in decomposition and plant production rates
- Changes in soil moisture due to shifting precipitation regimes and evapotranspiration rates
- Changes in soil organic matter concentrations
- A shift of winter precipitation from snow to rainfall, or changes in the frequency of rain-on-snow flooding

Increased rain and snow runoff can also have implications for hill slope stability.

Observed and anticipated increases in fire frequency and severity in the Blue Mountains as a result of climate change also have implications for soils. High severity burns lead to higher rates of soil loss from erosion, greater duff reduction, loss in soil nutrients, and soil heating (McNabb and Swanson 1990 and Hungerford et al. 1991).

Management strategies that facilitate the conservation of soils in the face of climate changes include:

- Retaining forest floor detritus
- Avoiding carbon losses from uncharacteristically severe or frequent fire, or overgrazing
- Physical removal of biomass

Generally, the plan alternatives share plan components designed to conserve soils during project implementation, but they vary in the amount of potential soil disturbance from management activities. Alternative C has the fewest acres of timber harvest, so has the lowest likelihood that harvest disturbance will exacerbate climate change-induced soil drying and erosion. Alternative D has the greatest acres of timber harvest and, conversely, would have the highest likelihood that soil disturbance from harvest will exacerbate climate change-induced soil drying and erosion. More erosion control and stabilization measures on unstable hill slopes are projected for alternative C, potentially mitigating climate change-induced increases in runoff. With projections for the most improvement in fire regime condition class in dry and moist forests and the highest likelihood of preventing uncharacteristically severe wildlife, alternatives D and E would likely have the least fire-induced soil erosion.

# Air Quality

Air pollution has the potential to impact a variety of resources on National Forest System lands in the Blue Mountains, including visibility, water, soils, vegetation, and sensitive species of flora and fauna. Air pollution also has potential to impact human health. Activities, such as timber harvesting, livestock grazing, oil and gas well drilling and operations, road construction or maintenance, and prescribed fire, produce emissions that may affect air quality in and around the national forests.

**Key indicators:**

- Ambient air quality
- Visibility
- Acres of wildland fire(s)
- Acres of prescribed fires or tons of fuels treated on National Forest System lands

## Affected Environment

Federal land management agencies have the unique responsibility to protect the air, land, and water under their respective authorities from degradation associated with air pollution emitted outside the borders of agency lands (Clean Air Act, as amended 1990), as well as from the impacts of air pollutants produced within those borders. These mandates are established through a series of legislative and regulatory requirements (Clean Air Act, as amended 1990; Organic Act 1977, and Wilderness Act 1997). The Clean Air Act names six criteria pollutants: carbon monoxide, lead, nitrogen, ozone, sulfur dioxide, and particulate matter as both PM10 (particulate matter less than 10 microns in diameter) and $PM_{2.5}$ (particulate matter less than 2.5 microns in diameter). These pollutants create the framework for which National Ambient Air Quality Standards (NAAQS) are established. Amendments to the Clean Air Act name 187 toxic air pollutants and establish measures for reducing the concentrations of these substances in emissions to the atmosphere. A community that does not meet or attain the NAAQS is usually designated by the Environmental Protection Agency (EPA) as a nonattainment area. The city of La Grande was named a nonattainment area for particulate matter ($PM_{10}$) in 1991 and is the only area in the Blue Mountains to be so named. An air quality maintenance plan was developed by Oregon Department of Environmental Quality (ODEQ), which resulted in control measures for sources of particulate matter within the La Grande Urban Growth Boundary. EPA approved a revised Air Quality Maintenance Plan for La Grande and changed its status to attainment, effective July 19, 2006. La Grande is now designated as an Air Quality Maintenance Area for PM10 and is the only area with this designation in the Blue Mountains.

The Clean Air Act has established three classes of airsheds with varying levels of protection: classes I, II and III. Class I provides the highest level of protection and includes Forest Service wilderness areas larger than 5,000 acres that were designated before August 1977. Three Class I areas are located in the Blue Mountains: Strawberry Wilderness Area, Eagle Cap Wilderness Area, and Hells Canyon Wilderness Area. Within Class I wilderness areas, the Forest Service has specific responsibilities for protection of air quality. This responsibility is carried out through the prevention of significant deterioration (PSD) permit process.

Within the Blue Mountains, smoke from wildland and prescribed fires is the dominant source of air pollution, but pollution affecting air quality in the Blue Mountains can and does occur outside of the Blue Mountains and may originate from anywhere in the western U.S. and Canada, depending on prevailing wind conditions.

Smoke emissions from Forest Service fuels treatments and prescribed fires on National Forest System lands are regulated by state Smoke Implementation Plans (SIP) in Oregon, Washington, and Idaho. From 1994 through 2008, $PM_{10}$ emissions from the Malheur, Ochoco, Umatilla, and Wallowa-Whitman National Forests were limited to a combined 15,000 tons per year. $PM_{10}$ emissions averaged approximately 4,150 tons per year from 1994 through 2001, or about 28 percent of the emissions allowed by the Oregon Smoke Management Plan (OSMP). Beginning in 2009, smoke management has been regulated by fee-based systems in Oregon and Washington that recognize the benefits of fuels reductions and prescribed burning to national forest resources while encouraging reductions in smoke emissions.

The OSMP has regulated smoke emissions from all sources since 1994. While smoke from wildland fires normally cannot be controlled, smoke emissions from other sources on National Forest System lands have complied with those regulations. The OSMP emissions cap of 15,000 tons PM10 per year from prescribed fires and fuel treatments has never been exceeded.

The OSMP identifies Baker City, La Grande, Enterprise, Burns, John Day, and Pendleton as Smoke Sensitive Receptor Areas (SSRAs). The objective of the OSMP is to restrict smoke intrusions into these communities. Where smoke intrusions cannot be avoided, the use of best management practices to control burning conditions is intended to vent smoke plumes up and minimize residual smoke. In all other instances of prescribed burning, it is the intent of the OSMP to minimize the amount and duration of smoke that comes into contact with humans at their places of residence or at places where they normally gather (OAR 629-048-0120).

### Air Quality Tradeoffs between Prescribed Fire and Wildland Fire Emissions

Smoke from wildland fires is the most prevalent source of impacts on air quality in the Blue Mountains. Smoke from prescribed and wildland fires contains carbon monoxide, sulfur dioxide, nitrous oxides, particulate matter, volatile organic compounds (Liu 2004), and mercury (Friedli et al. 2003). Particulate matter ($PM_{10}$, $PM_{2.5}$) in wildland fire smoke is of greatest concern because of known human health effects.

The existing wildland fire regime is significantly different than it was historically because of increased fuel loading, development of fuel ladders, and increases in stand density. Approximately 10 percent of acres burned now are nonlethal underburns, while approximately 31 percent of acres burned were nonlethal underburns historically. Stand replacing fires consume much more fuel and produce much more smoke than nonlethal fires, which usually burn with fairly low surface fire intensities in the understory. Brown and Bradshaw (1994) found that emissions were greater from current fires, even though they burn fewer total acres than what burned historically, because consumption of fuel per unit area burned is greater in the current period.

Prescribed fires are ignited when fuel moisture conditions are optimal for reducing total fuel consumption. Prescribed fires are designed to disperse smoke away from populated areas and are not conducted during inversions. Summer inversions are a major cause of bad ambient air conditions associated with wildland fires.

While increasing prescribed fires can have temporary negative impacts on air quality, in the long term, the acute impacts to air quality from wildland fires can be reduced as a result (Weise et al. 2003). During the last 10 years, measurements of $PM_{10}$ from wildland fires in urban areas well exceeded the NAAQS, and state regulators and scientists found it common for these episodes to last several days. For example, the 1994 wildland fires near Wenatchee, Washington produced 24-hour concentrations of $PM_{10}$ that were more than double the Federal health standard, and these conditions persisted for days. Impacts to populated areas from prescribed fire emissions can be more frequent, but the impact is well within established health standards for $PM_{10}$ (Earth Tech. 1996).

### Analysis Assumptions

Air quality within the plan area, due to regional transport winds, can be affected by actions that occur at considerable distances from the area. The distance from these sources helps to buffer any potential adverse industrial/metropolitan pollutants. Population growth in the Pacific Northwest and southwestern Idaho, centered in Boise, may diminish this buffer in coming decades.

Current air quality effects on wilderness areas and surrounding Class 2 lands is primarily from smoke and regional haze that affects large areas of the West under certain, poorly understood conditions. The issue of regional haze and its effects on western vistas has been and is being studied at a scale beyond this analysis in programs, such as the Grand Canyon Visibility Transport Commission. In addition, impairment reduction goals for visibility have been mandated by the EPA.

For the anticipated effects on air quality in the Class I airshed, fire ignitions are the primary source of visual impairment. Refer to the Forested Vegetation, Timber Resources, and Wildland Fire section for estimates of fire by type and by alternative.

Natural ignitions allowed to burn under prescribed conditions produce approximately 22 percent less $PM_{10}$ emissions per burned acre than wildland fires. Because tree crowns are not normally consumed and fuels moisture is higher, prescribed fires produce at least 37 percent less emissions per burned acre than wildland fires.

Smoke from prescribed fires would be managed by burning on days when air quality degradation can be minimized. How well the smoke will disperse is a key consideration in prescribed fire burning planning, and coordination will help ensure that prescribed fires will not violate the state standard for particulate matter. For all prescribed fire activities, site-specific environmental analyses will be conducted in accordance with agency direction in place at that time.

Legal considerations regarding smoke produced from wildland fire and prescribed fire use fall under the EPA's Exceptional Events Policy. When exceptional events occur, normal planning and regulatory processes established by the Clean Air Act are not required. Properly managed prescribed fire and wildland fire use activities are exceptional events according to the policy, and wildland fire is considered to be a natural event; pollution caused by these events is not subject to violations of NAAQS.

For all Forest Service site-specific projects, road dust would be evaluated if it is expected to present air quality issues. Mitigation measures, including road surfacing; season of use, daily time, and use restrictions; road closures; dust abatement products or road watering; and requiring lower speeds on gravel and native surface roads, may be implemented.

**Key Indicator:** Potential particulate emissions generated from prescribed fire

## Environmental Consequences – Air Quality

### Effects Common to All Alternatives

Both wildland fires and prescribed fires would generate smoke and particulates that could temporarily degrade visibility and ambient air quality conditions in downwind sensitive areas. The risk of adverse air quality impacts from fires would increase with the acreage burned.

Effects to air quality from permitted livestock would be negligible. Livestock grazing can generate dust, which can affect visibility and particulate levels. Dust impacts are expected to occur only in localized areas and for limited and short durations. Overall, the effects would be undetectable on an allotment, county, or forestwide scale, and the effects of livestock grazing on air quality would not vary measurably between alternatives.

For national forest travel routes impacts on air quality, vehicle emissions and dust from traffic on unpaved roads are the primary sources. These effects typically are localized and temporary, and their extent depends on the amount of traffic. Dust from unpaved roads increases with dryness as well as vehicle weight and speed.

Motor vehicle recreation occurs year-round. Summer use includes off-highway vehicles. Localized impacts from traffic on unpaved roads (dust) have not adversely affected air quality in sensitive areas (e.g., those with important scenic vistas). As use of the national forest transportation system increases with greater visitation, road dust impacts to sensitive areas may need to be addressed. Effects of motor vehicle emissions on air quality are not expected to result in measurable variations from the existing condition for any of the alternatives. Most of the effects of motor vehicle recreation are expected to be localized and temporary.

Winter motor vehicle recreation is mostly limited to snowmobiles. Emissions from these vehicles include carbon monoxide, oxides of nitrogen, and particulate matter. While snowmobiles can produce what is referred to as nuisance emissions, the potential for conflict is relatively low and of short duration (except within small, localized areas).

### Effects from Each Alternative

None of the alternatives are expected to substantially change existing air quality. Temporary reductions in visibility and fine particulate matter increases may occur on the national forests or in population centers downwind from sizeable wildland fires.

Even though the effects of alternatives are expected to be localized, both wildland fires and prescribed fires generate smoke and particulates that can temporarily degrade visibility and ambient air quality conditions in downwind sensitive areas. Alternatives with the most fuels treatment (prescribed fire) acres proposed are alternatives B, E, and F. Alternative D proposes the least. Alternatives that emphasize natural processes would have the greatest potential for wildland fire and the most acres potentially impacted. Alternative C includes the most prescriptions that would emphasize natural processes.

### Cumulative Effects

Cumulative effects include the list of past, present, and reasonably foreseeable future activities considered with regard to cumulative effects to air quality. Generally, long-term air quality impacts would likely come from adjacent communities as populations increase. Emissions could come from both mobile and stationary sources. Mobile source contributors include vehicle exhaust, dust from construction activities, and dust from road traffic within and near the Blue

Mountains. Stationary source contributions from outside the national forests include industrial and commercial operations.

Only minor road construction would occur for any alternative. The cumulative effects of road construction, reconstruction, or maintenance on air quality would not vary measurably between alternatives and would contribute only a small amount of the road-related air pollution in the region. Recreational traffic on national forest roads for all alternatives is expected to increase in response to an increasing population. Overall, air quality impacts generated by recreational use of roads would not vary measurable between the alternatives. As growth continues, pollution generated by vehicles would increase. The cumulative road-related effects on air quality would not vary measurably between the alternatives.

Cumulative effects of motor vehicle travel on air quality are unique in that past impacts to air quality are not usually evident. The emissions associated with motor vehicle travel would be cumulative only with local emission sources described in the affected environment. Since motor vehicle emission sources within the national forests would be localized and transient, actual cumulative combinations of emissions would be minor and would not result in significant effects.

Smoke from wildland and prescribed fires can adversely affect air quality. Private lands, state lands, and lands managed by the Bureau of Land Management surround the plan area. Smoke from prescribed burning operations on these lands could individually, or in combination with other fires, affect air quality in the national forests and in surrounding communities. Burning activities are coordinated to help prevent the cumulative effects of these burns from unacceptably impacting air quality. For all alternatives, wildland fire would continue to periodically cause temporary deviations from air quality standards.

For all alternatives, cumulative effects from Forest Service management activities on air quality would be minor, and in general, temporary and localized. All of the three national forests currently meet state and Federal air quality standards and show no degradation to visibility or other air-quality-related values. Compliance with local, state, and Federal air quality regulations would ensure that Forest Service management activities for any of the alternatives would continue to protect air quality. Management activities would not degrade the air quality of surrounding areas. Oregon and Washington have regulatory authority for controlling emissions, including those with potential to adversely impact national forest resources.

The cumulative effects of smoke could be significant when conditions for smoke dispersal are not satisfactory. Smoke and other pollutants that originate from outside the plan area that would contribute to visibility impairment are not likely to be the same for all alternatives and could mask differences between them.

Emissions from all fire types are expected to decrease through time (50 to 100 years) when residual fuel levels and landscape conditions approach historic accumulations. Climate change may make this prediction less certain.

### Effects of Climate Change on Air Quality

Climate change will continue to effect air quality, primarily through changes in fire regimes. A warmer climate, reductions in snowpack, changes in the timing of snowmelt, early declines in soil moisture, changes in the timing and length of the growing season, and increased drought have already lead to more frequent fires, more severe fires, earlier initiation of the fire season, and a longer fire season in the western United States relative to historical levels (Westerling et al. 2006). For more detail, see the cumulative effects discussion of the Forested Vegetation, Timber

Resources, and Wildland Fire section. With these changes, the contribution of fire to regional haze and reduced visibility is expected to increase in some areas (McKenzie et al. 2006).

Most sources of greenhouse gas (GHG) emissions are point source; however, large stand replacement fires on National Forest System lands can be a major source of GHG emissions and particulates. Increased wildfire activity can result in increases in particulate emissions, carbon monoxide, carbon dioxide, ammonia, and other pollutants from National Forest System lands. Changes in atmospheric circulation may lead to longer durations and more frequent periods of stagnant air, contributing to localized increases in adverse effects from criteria pollutants, such as ozone, particulate matter, and nitrogen oxides (Jacob and Winner 2009). Mercury occurs in the atmosphere at low concentrations and is deposited in surface waters and on vegetation and soils. The concentration of mercury is increased by biological activity, beginning with the activity of microorganisms in soils (US EPA 2010). Increases in wildfire activity and the increased soil respiration due to higher temperatures can potentially release large amounts of mercury to the atmosphere (Wiedinmyer and Friedli 2007). Emissions from prescribed burning for all alternatives are expected to be minor, and they would reduce overall emissions by reducing large wildfire risk.

The relative effects of climate change would not vary measurably between the alternatives. Alternatives D and E include the most thinning and prescribed fire treatment proposals, which would create the most open canopy stands and would result in the greatest decrease in high severity fire. In the dry forest potential vegetation group, the fire regime condition class would improve the most at year 50 for alternative D. This improvement would reduce the risk of uncharacteristically severe wildfires the most and would also achieve the greatest reduction in risk of impacts on air quality and greenhouse gas emissions.

In the dry forest potential vegetation group, alternatives A and C would have the most departed fire regime condition class at year 50 and would have the most uncharacteristically severe fires as a result. Being the most departed would result in the greatest impact on air quality and GHG emissions. For alternative C, wildland fire would be used the most to achieve desired conditions, and thinning and prescribed fire treatments would be used the least to reduce the risk of uncharacteristically severe wildfire.

See the Forested Vegetation, Timber Resources, and Wildland Fire section for more information on climate change effects related to wildfire risk.

# Watershed Function, Water Quality, and Water Uses

## Introduction

The watersheds, rivers, and streams of the Blue Mountains national forests in northeastern Oregon and southeastern Washington provide many ecological, economic, and social benefits. More than 30,000 miles of rivers and streams and 1,700 lakes and ponds support diverse communities of aquatic and terrestrial species, including salmon and steelhead. Tens of thousands of people rely on water from the national forests for drinking water, recreation, agriculture, industry, hydropower generation, and other uses.

This section describes the affected environment, existing conditions, and environmental consequences of the alternatives on watersheds, water quality, and water uses. Some of the effects on or arising from other resources, including soils, forested vegetation, wildfire, and livestock grazing, are mentioned in this section but are discussed in more detail in other sections. This section uses the terms subbasin, watershed, subwatershed, key watershed, and priority watershed. In some cases, the word watershed is used generically to denote the drainage area that contributes runoff to a common stream. Subwatersheds, watersheds, and subbasins are also known in the hydrological terminology currently used in the United States as successively larger hydrologic units. Hydrologic units may also be denoted numerically. For example, the Lower John Day subbasin is a 4th-level subdivision of the Columbia River region and is denoted by an 8-digit hydrologic unit code, or HUC4, of 17070201 consisting of four 2-digit pairs of numbers. This hierarchy is illustrated in figure 15. Subwatersheds typically comprise areas of approximately 10,000 to 40,000 acres, watersheds have areas of about 40,000 to 250,000 acres, and subbasins have areas of greater than 450,000 acres. Key and priority watersheds, whenever the terms are used in this section, refer to subwatersheds as displayed in appendix B.

## Setting

The climate of the Blue Mountains is largely continental with cold winters and hot, dry summers. Annual precipitation for the period from 1971 to 2000 ranged from less than 10 inches in low elevation valleys to more than 100 inches at the uppermost elevations in the Wallowa Mountains. The majority of precipitation falls as snow between October and April. Summers are usually dry and summer precipitation is associated with thunderstorm activity. The combined runoff of all rivers originating in the Blue Mountains totals about 7.4 million acre-feet per year, of which 5.2 million acre-feet (70 percent) originates in National Forest System lands (Gecy 2013e). Fifty to 80 percent of runoff is derived from snowmelt and occurs in spring and summer. Spring runoff begins as early as late February at lower elevations and continues into August in high elevation watersheds. Parts of the Blue Mountains that lie directly east of the Columbia River Gorge receive higher precipitation amounts from winter storms that are able to pass through the natural gap in the Cascade Range (Ferguson 1999).

Annual precipitation averages about 22 inches per year for the Malheur National Forest and about 33 inches per year for both the Umatilla and Wallowa-Whitman National Forests. Total precipitation in National Forest System lands amounts to about 13.5 million acre-feet per year, of which about 5.2 million acre-feet, or 38 percent, becomes streamflow. The ratio of runoff to precipitation varies from about seven percent in the Lower John Day subbasin to more than 64 percent in the Walla Walla subbasin, but may be higher or lower than this range in smaller watersheds.

Watersheds in National Forest System lands in the Blue Mountains are distributed among 8 hydrologic basins and 25 hydrologic subbasins, and the amount of National Forest System lands varies by subbasin (see table 131). All rivers and streams in the Blue Mountains are tributaries of the Snake River, the Columbia River, or the closed basins of east-central Oregon. Major tributary rivers originating in National Forest System lands in the Blue Mountains include the John Day, Umatilla, Malheur, Burnt, Powder, Imnaha, and Grande Ronde rivers in Oregon and the Tucannon and Walla Walla rivers and Asotin Creek in Washington. Silver Creek, Silvies River, and several smaller streams flow into the closed Harney-Malheur Lakes basin that is at the northwestern-most extent of the Great Basin. The headwaters of all of these streams are located in National Forest System lands.

National Forest System lands in the Blue Mountains comprise about 25 to 30 percent of the combined area of all subbasins and from 1 to 73 percent of the area of individual subbasins (see table 131). Remaining lands include private lands, lands managed by state and Federal agencies, and American Indian reservations.

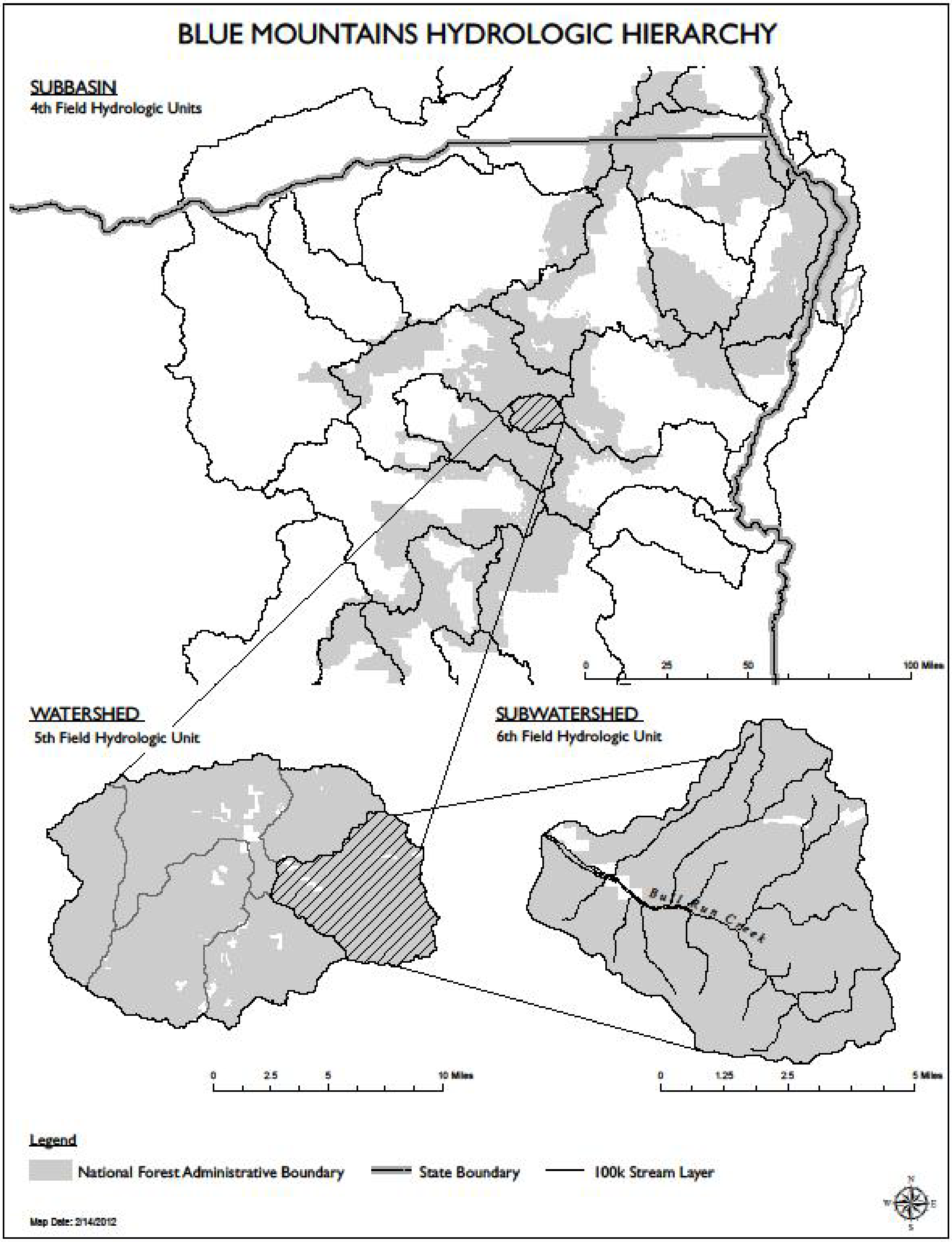


**Figure 15. Hydrologic unit hierarchy: outlined areas are individual subbasins, cross-hatched polygon (top) is a watershed (Granite Creek) within the North Fork John Day subbasin: cross-hatched polygon (bottom) is a subwatershed (Bull Run Creek) within the Granite Creek Watershed**

**Table 131. Acres of National Forest System (NFS) lands by subbasin within the Blue Mountains**

| HUC4 | HUC Name | MAL | UMA | WAW | NFS Acres | Total Acres |
|---|---|---|---|---|---|---|
| 17050116 | Upper Malheur | 370,342 | | 95 | 370,437 | 1,553,967 |
| 17050119 | Willow (Snake) | | | 2,890 | 2,890 | 485,731 |
| 17050201 | Brownlee Reservoir | | | 137,468 | 137,468 | 834,147 |
| 17050202 | Burnt River | 61 | 38 | 199,494 | 199,592 | 703,512 |
| 17050203 | Powder River | | | 355,148 | 355,148 | 1,093,330 |
| 17060101 | Hells Canyon | | | 252,167 | 252,167 | 346,521 |
| 17060102 | Imnaha River | | | 384,396 | 384,396 | 544,438 |
| 17060103 | Lower Snake-Asotin | | 63,122 | 47,220 | 110,343 | 450,287 |
| 17060104 | Upper Grande Ronde River | | 85,908 | 391,100 | 477,008 | 1,047,265 |
| 17060105 | Wallowa River | | | 282,572 | 282,572 | 610,666 |
| 17060106 | Lower Grande Ronde | | 252,894 | 234,208 | 487,102 | 971,746 |
| 17060107 | Lower Snake-Tucannon | | 77,265 | | 77,265 | 933,447 |
| 17060209 | Lower Salmon* | | | 119 | 119 | 30,779 |
| 17060210 | Little Salmon River* | | | 13,936 | 13,936 | 80,437 |
| 17070102 | Walla Walla | | 100,919 | | 100,919 | 1,126,790 |
| 17070103 | Umatilla | | 178,955 | 5,341 | 184,296 | 1,611,345 |
| 17070104 | Willow (Columbia) | | 12,063 | | 12,063 | 555,626 |
| 17070201 | Upper John Day | 427,376 | | 2 | 427,378 | 1,368,978 |
| 17070202 | North Fork John Day | 36,927 | 564,996 | 89,780 | 691,703 | 1,182,939 |
| 17070203 | Middle Fork John Day | 270,494 | 20,820 | 31 | 291,345 | 506,976 |
| 17070204 | Lower John Day | | 46,942 | | 46,942 | 2,019,400 |
| 17070303 | South Fork Crooked | 14,177 | | | 14,177 | 980,018 |
| 17120001 | Harney-Malheur Lakes | 46,791 | | | 46,791 | 948,213 |
| 17120002 | Silvies | 388,742 | | | 388,742 | 813,847 |
| 17120004 | Silver | 154,111 | | | 154,111 | 1,085,632 |
| | **Totals** | **1,709,020** | **1,403,922** | **2,395,969** | **5,508,911** | **21,886,039** |

## General Land Use History

During the last 150 years, watershed conditions in the Blue Mountains have been altered by a series of human uses, including mining, logging, agriculture, water diversions, flood control, wildfire exclusion, grazing, road construction and maintenance, and hydro-electric development. The combined impacts of past land uses include, but are not limited to changes in vegetative conditions, simplification and loss of aquatic habitats, increases in sediment delivery to streams, and degradation of riparian and floodplain functions (McIntosh et al. 1994a, Wissmar 2004). The resulting degradation and fragmentation of aquatic and riparian habitats and impacts to water quality contributed to declines or outright extinction of many resident and anadromous fish stocks, the listing of several fish stocks under the Endangered Species Act, and the listing of many streams as water quality impaired beginning in the early 1990s.

### Recent Past

PACFISH (USDA and USDI 1995) and INFISH (USDA Forest Service 1995) were implemented in response to the potential listing under the Endangered Species Act of several anadromous and resident fish species in the Snake River and interior portions of the Columbia River basin and included measures that were intended to halt further degradation of the habitats of these species on federal lands. Both strategies include:

- Designation of riparian habitat conservation areas (RHCAs) to be managed for the benefit of aquatic- and riparian-dependent species
- Identification of and increased protection of watersheds supporting listed species in good condition or that could be restored
- Requirements for land management activities, and
- Monitoring

Key elements of PACFISH and INFISH were incorporated into existing forest plans by amendment in 1995. Subsequent Biological Opinions by the National Marine Fisheries Service (NMFS 1995, 1998) and USFWS (1998) specified additional requirements for the protection and restoration of aquatic and riparian habitats in National Forest System and BLM lands, including the development and implementation of an area-wide monitoring strategy (PIBO, Kershner et al. 2004) to track the effects of implementing the two strategies, the development of a regionwide watershed and aquatic restoration strategy (USDA Forest Service 2005), and an analysis of the effects of forest roads (Road Density Analysis Team 2002).

PACFISH and INFISH both specified watershed analysis as a necessary tool for identifying desired conditions and restoration opportunities but did not include formal guidance for watershed and aquatic restoration.

PACFISH and INFISH were intended as interim strategies that were expected to be replaced upon finalization of the Interior Columbia Basin Ecosystem Management Project (ICBEMP) (Quigley et al. 1997). ICBEMP was expected to provide the long-term strategy used on federal lands in the interior Columbia River basin.

Subsequently, the Forest Service developed the Aquatic and Riparian Conservation Strategy (ARCS) (USDA Forest Service 2008) as guidance intended to provide a regionally consistent approach to the management of watersheds and riparian and aquatic habitats. The rationale for the ARCS was based on lessons learned from 15 years of successful implementation of PACFISH, INFISH, and the Northwest Forest Plan (FEMAT 1993). PACFISH and INFISH, and the development of the ARCS are discussed in more detail in the Aquatics Species, Diversity and Viability section.

The Pacific Northwest Region of the Forest Service developed guidance for aquatic habitat restoration on national forest system lands in 2005. The regional Aquatic Restoration Strategy (ARS) prioritized river basins and watersheds for the purposes of investing in the most critical areas and completing whole watershed restoration (USDA Forest Service 2005).

### Community-based Watershed Restoration

In the early 1990s, the Northwest Power Planning Council selected several watersheds in the Blue Mountains watersheds with high fisheries values, including the Asotin, Pataha, Tucannon, and Grande Ronde model watershed programs to support and promote cooperative restoration.

Three American Indian treaty tribes, the Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, and Confederated Tribes of the Warm Springs Indian Reservation, have been major sponsors of watershed restoration on ceded lands in the Blue Mountains for decades. The Oregon Watershed Enhancement Board, a state agency, provides grants to help Oregonians care for local streams, rivers, wetlands and natural areas. In 1999, the Washington state legislature created the Salmon Funding Recovery Board to provide funding for elements to support overall salmon recovery and other activities that benefit salmon. The Forest Service has joined in community-based partnerships through these and other programs and has cooperators in every basin in the Blue Mountains.

Of the 25 subbasins displayed in table 131, national forests in the Blue Mountains manage roughly 25 percent of the land base, not including lands managed by the Ochoco National Forest in the Lower John Day and South Fork Crooked sub-basins. Remaining lands include lands owned or managed by the Bureau of Land Management, Tribes, state lands, and private lands.

## Affected Environment – Watershed Function, Water Quality, and Water Uses

The following discussion describes the affected environment for watershed function, water quality, and water uses. Watershed condition is described in terms of its component parts, described here as hydrologic function, stream channel function, riparian and wetland function, and water quality. Soils are partially addressed here as part of hydrologic function, but are addressed in more detail elsewhere in this document. Aquatic habitat is considered a component of watershed condition and is addressed separately in this document.

**Key indicators** for watershed function used in this analysis are:

- Upslope conditions within watersheds based on changes in forested vegetation condition, hydrological connectivity of the road system, and grazing use intensity
- Grazing influence on riparian habitats
- The extent of riparian habitat conservation areas or riparian management areas
- Riparian, stream channel, and aquatic habitat restoration (miles and acres)
- Detrimental soil conditions resulting from timber harvest
- Changes in overall watershed conditions

Indicators for water quality include all of the previous items in addition to objectives for:

- Water quality restoration plans implemented

### Watershed Function

Naiman et al. (1992) described the fundamental components of ecologically healthy watersheds as basin geomorphology, hydrologic pattern, water quality, riparian forest characteristics, and habitat characteristics and proposed that ecologically healthy watersheds require preservation of the interactions between these components as well as the spatial and temporal variability of system components. Following Naiman et al. (1992), watershed function, as used in this analysis, includes: watershed condition, hydrologic function, riparian and wetland function, water quality, and stream channel and aquatic habitat function. A more detailed description of these functions and their relation to watershed condition can be found in Gecy (2013b) in the project record.

Some aspects of watershed-related functions or conditions are also discussed in the following sections of this document:

- Livestock Grazing and Grazing Land Vegetation;
- Aquatic Species Diversity and Viability; and
- Plant Species Diversity and Threatened, Endangered, and Sensitive Plants

The components of watershed function, as described in this section, all have influence on the diversity and viability of aquatic species as described in the Aquatic Species Diversity and Viability section. Watershed function also relates to water quality and water uses as discussed in this section.

Watershed conditions in the Blue Mountains were assessed through the use of a sustainability model based on the Ecosystem Management Decision Support System (EMDS; Reynolds 1996, 1999). The methods used are described in detail in (Gecy 2013a). The basic approach uses detailed analysis of watershed, riparian, stream channel, and aquatic habitat attributes. Assessment of the state of these attributes is used to define the condition of the approximately 550 subwatersheds containing National forest System lands in the Blue Mountains. The specific methods and assumptions used in the analysis are described in more detail in appendix B of this document and in Gecy (2013a) and Reiss et al. (2008).

Riparian and stream channel conditions were evaluated using riparian vegetation type, departure from historic range of variability, relative grazing use intensity, and riparian hardwood/shrub abundance. Channel and habitat attributes included average residual pool depth, pool frequency, and percent side channel, the percentage of unstable banks, the frequency of pools deeper than three feet, and large wood frequency.

The distribution of existing riparian conditions from the analysis shows 25 percent of habitats in good condition, 25 percent in poor condition; and all other habitats in an intermediate and moderately departed condition, relative to reference condition.

Impacts to riparian and aquatic habitats in the Blue Mountains increased rapidly following European settlement of the region (after 1850). Mining, agriculture, splash dams, logging, and livestock grazing each have had substantial impacts on streams in the Blue Mountains (McIntosh et al. 1994a, 1994b, Wissmar et al. 1994a, 1994b, Wissmar 2004). Of these activities, reaches where splash dams and log drives are known to have occurred stand out as having wider, shallower channels (and greater width-to-depth ratio), coarse substrate and lack of spawning gravel, lack of large woody debris, reduced channel complexity, and lower quality habitat. The width-to-depth ratio of streams in National Forest System lands is highly variable, and the measurement is subject to a high degree of observer error (Roper et al. 2008). This partially limits the usefulness of existing data. Still, available data suggests that width-to-depth ratio tends to increase with channel size and varies by channel type. The occurrence of unstable banks may be associated with greater channel width, but the effect of bank stability on width-to-depth ratio diminishes with channel size. The high variability of width-to-depth ratio indicates that many streams are in different stages of adjustment to land use impacts occurring at different times. For example, splash-dammed reaches can be distinguished from reaches where almost any other land use impact has occurred. This shows the importance of understanding land use history and the persistence of past impacts when assessing current channel conditions and identifying restoration needs.

Work by McIntosh (1992) and McIntosh et al. (1995) documents the decline in the quality and frequency of pool habitat and reduced frequency of large wood in streams in the Columbia Basin between the 1930s and 1980s. McIntosh (1994a, 1994b) showed that pool and large wood frequency declined in managed rivers in the Blue Mountains but increased in unmanaged (wilderness) watersheds during the same time period. Evaluation of aquatic habitat conditions has the highest level of uncertainty in the model because of the variability observed in the data and the influence this has on choosing reference conditions. Considering habitat features alone, model results indicate more subwatersheds with good habitat conditions (69) than poor condition subwatersheds (16), and most watersheds (477) display a midrange of habitat condition, although one or more individual features may exert more influence on existing condition.

Model results for overall existing watershed conditions place 105 of 552 subwatersheds in good condition (19 percent), 363 in fair condition (66 percent), and 84 in poor condition (15 percent).

### *Hydrologic Function*

Hydrologic function involves all of the processes involved in the conversion of precipitation to streamflow within watersheds. This includes the routing of water, sediment, and nutrients from hillslopes through the channel network and the interaction of physical, chemical, and biological processes (Naiman et al. 1992). Key influences on the hydrologic functioning of forest and rangeland watersheds include the condition and type of vegetation, ground cover, soil properties and conditions, and the nature and condition of riparian vegetation, all of which the affect rates of material inputs to streams, and the rate of watershed runoff.

Of more than 30,000 miles of rivers and streams in the Blue Mountains national forests, about 9,000 miles (30 percent) are perennial (flow year round) (see table 132). These streams provide habitat for diverse communities of vegetation, wildlife, anadromous and resident fish, and provide water for downstream uses that include crop irrigation, domestic livestock, municipal and domestic water supplies, hydropower generation, commercial, industrial, and other uses. Other important water resources in National Forest System lands include lakes and ponds, reservoirs, and springs and seeps, which provide important habitats for a variety of plant and animal species and are the source areas of many streams that support downstream uses (see table 133 through table 135).

**Table 132. Summary of stream miles in National Forest System lands (from national hydrographic dataset (NHD) flowline)**

| National Forest | Intermittent Streams | Perennial Streams | Totals |
|---|---|---|---|
| MAL | 2,983 | 2,593 | 5,576 |
| UMA | 4,999 | 2,259 | 7,258 |
| WAW | 13,151 | 4,394 | 17,544 |
| **Totals** | **21,113 (70%)** | **9,245 (30%)** | **30,378 (100%)** |

**Table 133. Other water resources within the Malheur National Forest (from NHD)**

| Water Resource Type | Quantity | Acres |
|---|---|---|
| Lakes and ponds | 498 | 308 |
| Reservoirs | 3 | 3 |
| Swamp/marsh | 16 | 42 |
| Springs and seeps | 2,851 | NA |

**Table 134. Other water resources within the Umatilla National Forest (from NHD)**

| Water Resource Type | Quantity | Acres |
|---|---|---|
| Lakes and ponds | 515 | 390 |
| Reservoirs | 31 | 6 |
| Swamp/marsh | 31 | 181 |
| Springs and seeps | 641 | NA |

**Table 135. Other water resources within the Wallowa-Whitman National Forest (from NHD)**

| Water Resource Type | Quantity | Acres |
|---|---|---|
| Lakes and ponds | 638 | 3,847 |
| Reservoirs | 77 | 26 |
| Swamp/marsh | 410 | 1,211 |
| Springs and seeps | 1,193 | NA |

### *Riparian and Wetland Function*

Riparian and wetland areas provide critical habitat for many terrestrial and aquatic species and important links between upland and stream habitats. Riparian areas occur within a zone where interactions occur between surface and groundwater, between the river and its floodplain, or between headwater streams and adjacent hillslopes (Stanford 1998).

Riparian habitats and riverine wetlands are composed of more than 180 distinct plant associations (Crowe and Clausnitzer 1997, Wells 2006) and occupy about 21,000 acres (1 percent) of National Forest System lands in the Blue Mountains, according to National Wetland Inventories for Oregon and Washington (USFWS 2010). Off-channel wetlands, many fed by isolated springs or groundwater, occur in a variety of settings and occupy an additional 31,400 acres of National Forest System lands (USFWS 2010). The acres of riparian and wetland habitats displayed on maps produced by the National Wetland Inventory are displayed in table 136. The area of riparian vegetation within the Blue Mountains is thought to be about 2 to 3 percent of total land area, or 110,000 to 165,000 acres (Hann et al. 1997), so it is likely that the NWI maps under-represent the area of riparian habitats by as much as 140,000 acres for the three national forests.

**Table 136. Riparian and wetland acres for each national forest**

| Wetland Type | MAL | UMA | WAW | Totals |
|---|---|---|---|---|
| Riverine (riparian) wetlands | 4,850 | 5,290 | 10,880 | **21,015** |
| Lacustrine and palustrine wetlands | 11,400 (4,439 sites) | 6,890 (3,190 sites) | 13,140 (5,500 sites) | **31,430 (13,129 sites)** |
| Total wetland areas[1] | 16,360 | 12,260 | 24,280 | **52,890** |

1 Total area includes small areas of unclassified wetland types. Source is National Wetlands Inventory. Areas subject to verification.

### *Land Uses Affecting Watershed Function*

Major land uses influencing watershed functions include roads, forested vegetation and timber harvest, wildland fire, grazing, and watershed restoration and are discussed in the following sections.

**Roads**

The hydrological effects of National Forest System roads include alteration of the rates of surface and increased rates of erosion and sediment delivery to streams and result in degraded water quality and aquatic habitat (Furniss 1991). Roads increase the rate of watershed runoff and contribute to reduced low flows, increased peak flows, or both, but these effects have not been shown to extend beyond single watersheds. The effects increase with increases in the hydrologic connection of roads to the stream channel network (Jones and Grant 1996, Wemple et al. 1996). Roads that are closer to stream channels have a greater potential for sediment delivery to streams (Haupt and Kidd 1965, Wemple et al. 1996), but Montgomery (1994) suggests that ridgetop roads may also contribute to increased runoff. Croke et al. (2005) found that the greatest contribution to runoff occurred at stream crossings where road runoff discharges directly into streams. McIntosh et al. (1995) observed that nearly 90 percent of streams in managed watersheds in the Columbia Basin had roads either along the channel or within the floodplain.

Effects of roads on watershed function vary greatly due to the influence of such factors as topography, geology, slope stability, road design, and the amount of traffic on a particular road (Bilby et al. 1989, Duncan and Ward 1985, Luce et al. 2001, Wemple et al. 2001, Swanson and Dyrness 1975, Sugden and Woods 2007). Rates of road surface erosion and sediment delivery to streams vary with disturbances (floods and fire), and range from episodic pulses to chronic contributions of sediment (Switalski et al. 2004).

Roads on National Forest System lands are known to intercept subsurface runoff from hillslopes and route it through the road drainage system into the stream channel network (Megahan 1972, Megahan and Clayton 1983). Wemple et al. (1996) cited two hydrologic flow paths that resulted in the integration of road systems and channel networks: roadside ditches that drain to streams and roadside ditches that drain to culverts with gullies below their outlets. These roads are considered “hydrologically connected.”[4]

The production of road-related sediment varies with geology (Duncan and Ward 1985, Sugden and Woods 2007). In steep terrain, roads increase the rates of hill slope failures and soil mass wasting (Swanston and Swanson 1976, Swanston 1991). McCashion and Rice (1983) noted that 51 percent of observed erosion occurred on roads constructed on slopes steeper than 60 percent. Fine sediments can be delivered to natural streams by erosion of road surfaces and from unvegetated road cut and fill surfaces (Reid and Dunne 1984). The amount of road surface erosion has been found to increase with the amount of road traffic (Reid and Dunne 1984, Bilby et al. 1989) and to vary with topography and sensitivity to land sliding and mass wasting (Furniss et al. 1991). Road-stream crossings are common sources of sediment, for example, when culverts become blocked by debris, and runoff is routed along the road surface (Furniss et al. 1998).

Road density has been used as a measure of past land use intensity, particularly in areas of active timber harvest (Lee et al. 1997, Sharma and Hilborn 2001). However, Lee et al. (1997) acknowledged the difficulty in discriminating the varying effects of roads over large landscapes and suggested that local conditions can have a large influence on runoff and sediment delivery from a given road segment. McCaffery et al. (2007) found significant relationships between fine sediment in streams and road density, open road density, and number of stream crossings. Jorgensen et al. (2009) used road density as one of several factors to predict stream temperatures and substrate characteristics in evaluation of habitat quality for Chinook salmon in the Wenatchee River in Washington. Cederholm et al. (1981) noted an association of fine sediment accumulation

[4] Hydrologically connected roads are defined as roads or portions of roads that route water and/or sediment directly to stream channels.

in headwaters streams in heavily roaded areas of the Clearwater River basin in Washington and noted an increase in sediment production by 2.6 to 4.3 times when road density exceeded 2.5 kilometers per square kilometer (4 mi/mi$^2$). An analysis of National Forest System roads within the Umatilla National Forest in the Wall Creek watershed indicates that 90 percent of road-related sediment is produced by 12 percent of the road network. This information is being used to target erosion reduction treatments to the most critical sites (Nelson et al. 2010).

Effects of roads to watershed function can be reduced by considering location, design, and management to disperse road runoff (Furniss et al. 1991). Examples include road surfacing (Burroughs and King 1989, Bilby et al. 1989), seasonal road closures to protect both unsurfaced and surfaced (i.e., crushed aggregate or gravel) roads from use during adverse weather, and designating undisturbed riparian zones along streams to allow filtering of fine sediments (Newbold et al. 1980). Madej (2001) found that road decommissioning greatly reduced road-related sediment delivery to streams but did not completely eliminate erosion associated with forest roads. Haupt and Kidd (1965) suggested that 30-foot wide riparian buffers were sufficient to prevent road-related sediment delivery to streams. In contrast, Ketcheson and Megahan (1996) suggested that 100-meter (330 feet) buffers may be insufficient to prevent sediment delivery to streams, depending on geology and the steepness of adjacent slopes.

Lastly, not all effects of roads are preventable. McCashion and Rice (1983), in a study of forest road effects in northern California, concluded that as little as 24 percent of road-related erosion was avoidable. In contrast, Megahan et al. (1992) concluded that, while some increases in sedimentation due to forest roads is unavoidable, road-related sediment delivery to streams in the Salmon River basin of Idaho could have been reduced by 45 percent to 95 percent using available management practices.

Miles of existing roads, open (ML2 through 5) roads, and riparian roads are displayed in table 137. Riparian roads, as used in this analysis, are approximated by the miles of roads within 300 feet of any stream channel. The resulting road densities are displayed in table 138.

**Table 137. Miles of existing roads and open roads for each national forest**

| Road Type | MAL | UMA | WAW | Totals |
|---|---|---|---|---|
| Existing roads | 9,508 | 4,486 | 9,020 | 23,014 |
| Open roads | 6,843 (72.0%) | 2,477 (55.2%) | 4,730 (52.4%) | 14,050 (61.0%) |
| Riparian roads | 1,552 (16.3%) | 556 (12.4%) | 1,200 (13.3%) | 3,308 (14.4%) |

**Table 138. Road density (miles) for each national forest**

| Road Type | MAL | UMA | WAW | Totals |
|---|---|---|---|---|
| Road density, including wilderness areas and existing roadless areas | | | | |
| Existing road density (all NFS lands) | 3.56 | 2.04 | 2.40 | 2.67 |
| Open road density (all NFS lands) | 2.56 | 1.13 | 1.26 | 1.63 |
| Road density, outside of wilderness areas and existing roadless areas | | | | |
| Existing road density | 4.23 | 3.48 | 3.71 | 3.86 |
| Open road density | 3.05 | 1.92 | 1.94 | 2.35 |

**Malheur National Forest** – There are 177 subwatersheds within or partially within the Malheur National Forest. The road miles and densities displayed in table 137 and table 138 occur in 165 of those subwatersheds. Open road density greater than one mile per square mile occurs in 139 subwatersheds, while 105 have open road density greater than two miles per square mile, and 11 have open road density greater than four miles per square mile. Out of 33 key watersheds displayed in the appendix, table B-4, 21 have open road density greater than two miles per square mile and four have open road density greater than four miles per square mile. Nineteen of 26 priority watersheds have open road density greater than two miles per square mile and three have road density greater than four miles per square mile. Since 1990, 1,740 miles of roads have been closed within the Malheur National Forest.

**Umatilla National Forest** – There are 162 subwatersheds within or partially within the Umatilla National Forest. The road miles and densities displayed in table 137 and table 138 occur in 143 of those subwatersheds. Open road density greater than one mile per square mile occurs in 74 subwatersheds, while 19 have open road density greater than two miles per square mile, and three have open road density greater than four miles per square mile. Out of 38 key watersheds displayed in the appendix, table B-54, two have open road density greater than two miles per square mile and none have open road density greater than four miles per square mile. No priority watershed has an open road density greater than two miles per square mile. Since 1990, 1,090 miles of roads have been closed within the Umatilla National Forest.

**Wallowa-Whitman National Forest** – There are 272 subwatersheds within or partially within the Wallowa-Whitman National Forest. The road miles and densities displayed in table 137 and table 138 occur in 219 of those subwatersheds. Open road density greater than one mile per square mile occurs in 143 subwatersheds, while 84 have open road density greater than two miles per square mile, and 11 have open road density greater than four miles per square mile. Out of 80 key watersheds displayed in the appendix, table B-6, 26 have open road density greater than two miles per square mile and four have open road density greater than four miles per square mile. Eleven of 26 priority watersheds have open road density greater than two miles per square mile and none have open road density greater than four miles per square mile. Since 1990, 1,415 miles of roads have been closed within the Wallowa-Whitman National Forest.

### Forested Vegetation and Timber Harvest

Forested watersheds in the western United States are generally areas of higher elevation and consequently have more precipitation and greater streamflow than surrounding areas. The effects of timber harvest on forested watersheds has been described in terms of evapotranspiration and site water balance, snow accumulation and melt rates, and influences on soil structure, infiltration, and water transmission rates (Chamberlin et al. 1991).

Stand density and leaf area index are both related to site water balance (Grier and Running 1977). Forested vegetation intercepts a percentage of precipitation that is evaporated back to the atmosphere (Patric 1966, Stewart 1977), and water that infiltrates forest soils is transpired through vegetation (Ziemer 1979). The combined effect of evaporation and transpiration (evapotranspiration) may comprise 20 to 80 percent of precipitation in western U.S. watersheds and appears to be regulated by the difference between precipitation and potential evapotranspiration (Riggs and Wolman 1990).

Removal of forested vegetation by timber harvest (Goodell 1967, Bosch and Hewlett 1982, Jones 2000, Lewis 2001) and high-severity fires (Helvey 1980, Megahan 1983) has been shown to increase watershed runoff, at least temporarily, until forest cover is restored (Farley et al. 2005).

Removal of vegetation in forested watersheds alters the watershed response to precipitation by reducing interception, evaporation, and transpiration and increasing soil water storage and runoff (Lewis et al. 2001, MacDonald and Stednick 2003). Water yield increases of 40 mm (1.6 inches) for each 10 percent change in forested cover have been documented in coniferous forests in the U.S. and elsewhere (Hibbert 1967, Bosch and Hewlett 1982), but this effect can be highly variable and may be decreased where young, fast-growing vegetation establishes quickly after logging (Hibbert 1967). Keppeler and Ziemer (1990) reported statistically significant increases in low flows and annual runoff following selective harvest in northern California but also reported that low flow increases diminished within five years. Ziemer (1964) reported that water savings from reduced evapotranspiration following clear-cutting diminished to zero after 16 years. The results of timber harvest effects on watershed runoff have been highly variable and have not been extended past small watersheds (Ziemer 1987).

The effect of forest management on watershed runoff in rain and snow-dominated watersheds has been an active area of research for decades (Troendle 1983, Slaughter et al. 2001). Snow accumulation is strongly associated with both meteorological variables and forest characteristics (Anderson 1967). At higher elevations, creation of canopy openings by timber harvest may result in changes in the water content in winter snowpack and in the timing of snowmelt (Troendle and King 1985). Timber harvest has been observed to increase snow accumulation in forest openings and to result in earlier snowmelt timing (Moore and Wondzell 2005), and there is some evidence to suggest that forest management may increase the volume of snowmelt runoff (Pike and Sherer 2003). Kattleman et al. (1983) suggested that limited potential existed to modify water yields in Sierra Nevada watersheds through forest management because of the rate of harvest required to increase water yield and the recovery time of vegetation between harvests would make it difficult to sustain any flow increase. A 30-year long study of watershed response to timber harvest in the northern Blue Mountains at the High Ridge evaluation area within the Umatilla National Forest showed water yield increases were small, lasting only a few years even with clear-cutting. As the study progressed in the 1980s, harvest effects to water quality from increased erosion and shade loss became more of a concern than the potential for increasing water yield. Practices used in the study, including clear-cutting and skidding across streams, were later restricted or prohibited (Helvey et al. 1995).

Processes that contribute to streamflow from adjacent hillslopes include overland flow, subsurface storm flow, and groundwater flow (Freeze 1974). In forested watersheds, the litter layer provides ground cover that contributes to high soil infiltration rates (Arend 1942) and low surface erosion (Plamandon et al. 1972). High infiltration rates in forested watersheds tend to limit the occurrence of overland flow (Harr 1977), except in cases where precipitation intensity exceeds infiltration capacity (Montgomery and Dietrich 1995), soils become saturated (Betson 1964, Dunne and Black 1970), or disturbance results in the loss of ground cover (Brandt 1987) or compaction of forest soils (Hills 1971).

The percent composition of the three dominant upland forest potential vegetation groups for each national forest, the average departure from the historical range of variability (HRV) as described in the forested vegetation section of this document, and the acres of the different potential vegetation groups are displayed in table 139. The departure is expressed as the percentage difference between existing stand density, structure, and species composition compared to reference conditions (NIFTT 2010), which in this analysis is the HRV. The methods used in the departure analysis are available from the project record. Dry upland forests have been the focus of timber harvest within the Blue Mountains national forests and are typically the most departed from historic conditions. The predominant direction of departure is towards dense stands of younger-aged trees and a decline in the number and distribution of older trees.

**Table 139. Upland forest potential vegetation groups percent of total acres and percent departure from HRV, and approximate acres for each national forest**

| Potential Vegetation Group | Percent Departure and Acres | MAL | UMA | WAW |
|---|---|---|---|---|
| Dry Forest | Percent of national forest [percent departure] | 72% [62%] | 43% [60%] | 34% [56%] |
| | Approximate acres | 1,220,000 | 600,000 | 612,000 |
| Moist Forest | Percent of national forest [percent departure] | 6% [36% | 31% [23%] | 8% [23%] |
| | Approximate acres of national forest | 102,000 | 434,000 | 144,000 |
| Cold Forest | Percent of national forest [percent departure] | 9% [54%] | 8% [13%] | 18% [37%] |
| | Approximate acres of national forest | 153,000 | 112,000 | 324,000 |

In the 1990 forest plans, 780,000 acres of the Malheur National Forest, 380,000 acres of the Umatilla National Forest, and 590,000 acres of the Wallowa-Whitman National Forest are considered suitable for timber production. The 1990 forest plans originally projected a combined annual timber harvest of 450 million board feet, but actual harvest levels declined sharply to an average of less than 100 million board feet per year in 2004. An average of 260,000 acres per year were expected to be harvested within all three national forests in 1990, compared to the actual average harvest of 76,000 acres from 1998 to 2002. One factor in the decline of timber harvest volume and acres harvested has been the limitations placed on timber harvest within riparian habitat conservation areas (RHCAs) following the implementation of PACFISH and INFISH in 1995. Within streamside zones, the departure of dry upland forests from the historical range of variability remains highly departed.

Beginning in 1995, management actions within RHCAs were intended to be limited to those that specifically benefitted aquatic and riparian-dependent habitats and the species that occupy them. RHCAs are estimated to include 168,550 acres of the Malheur National Forest, 237,500 acres of the Umatilla National Forest, and 360,100 acres of the Wallowa-Whitman National Forest.

### Wildland Fire

Wildland fire includes planned and unplanned ignitions.Unplanned ignitions may be either human caused or of natural origin. Planned ignitions (prescribed fires) are fires ignited by management and used under an existing management plan to achieve resource management objectives, including reducing the risk of high severity fire effects. Unplanned ignitions of natural origin may also be managed to achieve resource objectives under various strategies based on values at risk and resource management objectives. Wildland fire activities and the associated effects on forested vegetation are described in greater detail in the Forested Vegetation, Timber Resources, and Wildland Fire section. This section addresses the effects of wildland fire activities on watershed function, water quality, and water uses.

The forests in the Blue Mountains have historically developed under the influence of a variety of disturbances, including wildland fire, that have shaped species composition and stand structure (Johnson 1994, Agee 1998). The combined effects of forest management and fire exclusion since the early 1900s contributed to changes in forest structure and species composition, and the altered fire frequency and severity contributed to changes in forest patch size (Hessburg et al. 2005, Johnson 1994). Fire consumes vegetation, partially or completely removes ground cover, and may form water repellant (hydrophobic) soil layers depending on soil temperatures during the burn and the characteristics of the local vegetation and soils (Debano and Krammes 1966). Fire effects on watershed function depend on physical and biologic attributes of individual watersheds, on the severity of the fire, and on weather conditions following the fire. Low severity fires, by definition, consume little of the organic material that covers and protects the soil from surface erosion. High severity fires consume much of the above ground vegetation, soil organic material, and litter. Changes in ground cover can greatly increase the erosion risk of forest soils following a fire.

Increases in post-fire erosion in mountainous areas of the western U.S. highlight the impacts of wildland fire on watershed function (Roering and Gerber 2005). Erosion rates after large or high severity wildland fires may be elevated by more than a factor of 200 immediately after the fire (Morris and Moses 1987) but decline to background levels in as little as three years (Moody and Martin 2001). Debris flows and shallow landslides may occur following fires (Wondzell and King 2003) or following any other mechanism that removes surface vegetation or affects root strength on susceptible sites (Reneau and Dietrich 1987).

Historically, fire intensity was generally lower in riparian areas due to increased water availability and higher fuel moisture, but accumulations of fuels in riparian zones and the potential for increased fire severity in riparian areas in recent years has elevated concerns about riparian area fuels management (Dwire and Kauffman 2003, Halofsky and Hibbs 2008, Dwire et al. 2010). Additionally, increased conifer crown loadings and ladder fuels have resulted in increased fire severity in riparian areas, in comparison to historic conditions.

Prescribed fires used to reduce forest fuels typically create low severity burn conditions, but concentrations of fuels may burn at higher severities and develop areas of hydrophobic soil (Robichaud 2000). In a recent Blue Mountains study of prescribed fire effects on erosion and sediment delivery to riparian areas, treatments were found to have low on-site erosion and no sediment delivery to prescribed riparian protection zones (Harris et al. 2005).

High severity fire may result in increased streamflow due to loss of vegetation and decreases in evapotranspiration (Helvey 1980). Timber harvest following fire may have an additive effect on watershed runoff not observed in areas subject only to wildfire (Megahan 1983). Wildland fires are a source of large wood recruitment to streams (Bêche et al. 2005, Robinson et al. 2005), and woody debris may be mobilized and redistributed along streams following fires (Young 1994).

Planned fire ignition (prescribed fire) is a tool used to modify existing vegetation or reduce excess fuel loadings that would otherwise contribute to uncharacteristic fire conditions (Mitchell et al. 2009). In most of the forested areas of the western U.S., including the Blue Mountains, the role of fire in forest ecosystems has been altered by fire suppression and other management activities since 1900 (Hessburg and Agee 2003, Heyerdahl et al. 2001). Fire exclusion may have provided near-term protection from the effects of uncharacteristic wildfires to local watersheds but has also led to accumulation of fuels that increase the risk of high severity fire. Studies of year-to-year variability and seasonality of wildfires in the western U.S. also show the close association of climate conditions and the severity and extent of wildfires in the western U.S. (Littell et al. 2009, Westerling et al. 2003). Projected changes in temperature and precipitation for the Pacific Northwest are expected to increase the risks associated with high severity fires and increase the area burned (Littell et al. 2010).

Prescribed fire is often used either alone or in conjunction with forest thinning to reduce wildland fire risk (Graham et al. 2004, Agee and Skinner 2005). Prescribed fires and thinning may be used together in areas where high fuel accumulations exist due to long-term fire exclusion (Harrod et al. 2009). Research shows that the most effective method to reduce fire severity is to use prescribed fire in conjunction with forest thinning (Covington et al. 1997, Graham et al. 1999). Most prescribed fires are ignited under conditions that limit the potential for high severity fires (Wondzell 2001) and typically have less effect on soil organic matter and soil structure and result in lower risk of soil erosion compared to higher severity fires (De Bano et al. 1998). Management actions associated with prescribed fires that disturb the soil profile, such as mechanical fuel treatment, reopening roads for access to harvest sites, or construction of fuel breaks, may result in increased erosion risk. In recent years, the widespread occurrence of high severity fires has resulted in increased emphasis on finding ways to reduce potential fire severity in riparian areas (Elliott et al. 2010).

From 1960 through 1979, an average of 4,400 acres per year was affected by wildfires in National Forest System lands in the Blue Mountains, compared to an average of 26,500 acres per year from 1980 through 2000. A total of 445,000 acres were affected by lightning-started fires from 1985 through 1994.

### Livestock Grazing

Livestock grazing is among the most widespread land uses in the interior Pacific Northwest (Kauffman and Krueger 1984). Livestock grazing effects include trampling, soil compaction, and loss of vegetative cover on both upland and riparian sites (Platts 1991). As a result of heavy grazing, erosion and runoff from the breakup of soil crusts has been shown to accelerate (Blackburn 1983). Overuse in riparian zones affects the stability of stream channels, changes channel form (widening), and reduces resistance to floods (Marston 1994). While livestock grazing has effects on uplands, the focus of this section is on effects to riparian, stream, and aquatic habitats because of the sensitivity of these areas and their preferential use by domestic livestock.

Riparian areas of the western United States typically comprise one to two percent of summer range, but provide 20 percent of available forage (Clary and Webster 1990). Riparian vegetation provides several key functions in stream ecosystems, including the provision of shade, bank stability, nutrient transfer, retention of organic material, and source of woody debris (Gregory et al. 1991). Overuse of riparian vegetation by domestic livestock has been recognized as contributing to the decline of riparian shrubs along interior Pacific Northwest streams (Lee et al. 1997). McIntosh et al. (1995) noted that deteriorated range conditions in the Columbia River Basin had been documented by 1900 and that management practices improved after about 1930.

Impacts of livestock grazing are often greater in riparian zones because these areas are used preferentially because of the availability of shade, water, and more succulent vegetation (Bryant 1982, Platts 1991). Brookshire et al. (2002) suggest that relatively light levels of livestock grazing, combined with intense wild ungulate browsing, can affect plant structure and limit reproduction of riparian willows. Holechek et al. (2006) suggested that adverse effects of grazing could be avoided if use intensity, expressed as a percentage of long-term average forage production, did not exceed about 40 percent of forage produced in a given area. Elmore (1992) suggests that stream and riparian habitat conditions can be improved with proper grazing management.

Changes in grazing management, such as rest, implementation of rest-rotation grazing schemes, reduced livestock numbers, and adherence to forage utilization standards, have led to improved range, riparian and stream channel conditions (Gifford and Hawkins 1976, Elmore 1992, Nagel and Clifton, 2003). Changes in grazing practices in the 1930s, 1950s, and since 1970, have improved range conditions across the three national forests compared to conditions in the early 1900s.

Additional measures restricting the management of livestock in National Forest System lands were implemented following the establishment of PACFISH and INFISH guidelines in 1995, which were intended to provide protection for anadromous and resident fish, riparian areas, and water quality. For example, the majority of perennial streams on several allotments were fenced to exclude or restrict livestock access, and monitoring data indicate that some riparian and channel attributes have improved in the Blue Mountains (Archer et al. 2009).

Livestock grazing may result in long-term impacts to aquatic systems, especially from changes in ground cover, shifts in species composition, and changes in sedimentation rates that are difficult to discern because streams are dynamic and variable (Platts 1991). In addition, degraded stream channels may remain in relatively poor condition long after the original impact because of changes in stream channel conditions, making it difficult to identify the principal cause of degradation. Maloney et al. (1999) reported elevated stream temperatures in intensively grazed watersheds in the John Day basin, and the lowest stream temperatures were observed in ungrazed watersheds, but results were confounded by 100 years of prior grazing history.

Beaver were historically abundant in parts of the Blue Mountains (Cline 1988). The contributions of beaver dams in small streams are similar to the functions often attributed to large woody debris in larger streams (Pollock 2003). Beaver dams are sources of organic material to streams and are sites of nutrient retention that increase stream productivity (Naiman et al. 1986, Naiman et al. 1994). Beaver dams dissipate stream energy and provide channel stability (Gurnell 1998). They also create habitat diversity that benefits numerous other species (Pollock et al. 1995, Snodgrass 1997, Wright et al. 2002). The presence of livestock in areas of potential beaver habitat produce competition for limited food resources (Marston 1994) and can disrupt the beaver-willow mutualism that occurs in less competitive environments (Baker et al. 2005). Riparian management practices that favor shrub production also favor the positive benefits of beaver-created landscapes (Munther 1982).

About 42 percent of the National Forest System lands in the Blue Mountains are classified as suitable for sheep or cattle grazing. This includes 1.3 million acres within the Malheur National Forest (81 percent of the national forest), 344,000 acres within the Umatilla National Forest (25 percent of the national forest), and nearly 433,000 acres within the Wallowa-Whitman National Forest (24 percent of the national forest).

Animal unit months (AUMs) totaled about 290,000 for the three national forests in 2009, an average of about 34 acres per AUM. Some livestock grazing occurs within 455 of 552 subwatersheds within National Forest System lands in the Blue Mountains. In order to evaluate relative levels of livestock use within the national forests, available estimates of forage production by vegetation type from Countryman and Justice (2010) were compared to forage use based on stocking levels as of 2009. Use intensity was then compared to use categories by Holechek (2006) who suggested that good range conditions could be maintained with average forage use of 40 percent or less of forage production. Results indicate that average livestock forage use across all three national forests averages about 13 percent of forage production.

## Watershed Restoration and Monitoring

During the last two decades, efforts to protect and restore watershed functions within the national forests have progressed. In the 1990s, there was a focus on individual stream reaches and on restoring specific attributes (for example, placing instream structures to create pool habitat). Beginning in 2000, efforts were made to prioritize restoration actions across subbasins and watersheds. Finally, beginning in 2005, whole watershed restoration plans were developed to address upland contributions to watershed functions, in addition to streamside and aquatic habitat conditions, and to identify the most critical restoration needs to improve watershed conditions, from passive protection to active restoration.

Aquatic habitat and riparian conditions within reference and managed watersheds have been monitored since about 2000 by the PACFISH-INFISH Biological Opinion Monitoring Program (PIBO, Archer 2009). Data collected by this program includes measurements of 13 channel-habitat attributes and 11 vegetative attributes. Preliminary results of repeat sampling of 218 monitoring sites in the Blue Mountains show favorable changes in 8 of 11 habitat attributes on managed (grazed) sites (3 significant), and favorable changes in 9 of 11 vegetation attributes (4 significant). One of the notable features of the data is the large difference in some attributes between reference (ungrazed) sites and managed (grazed) sites. While there may be reason for caution in comparing reference and managed conditions directly, Kershner et al. (2004) suggest this as a credible way to report conditions in lieu of trend information from individual sites.

Compared to reference reaches, managed reaches tend to have a lower habitat index, lower residual pool depth, and lower pool area but also have higher pool frequency (Al-Chokhachy et al. 2010). Managed reaches tend to have less bank stability and less wood volume. Managed reaches also tend to have less vegetative cover, more cover of nonnative species, and less cover by woody species.

Monitoring data are showing improvements in riparian and habitat conditions on managed sites but not all attributes and not all sites show favorable trends. Also, while there has been sufficient data collected to show significant changes in some attributes at the scale of the Blue Mountains, the data are not yet sufficient to determine changes at the scale of individual national forests. The monitoring framework in appendix A identifies monitoring questions and parameters that address the status and trend of watershed and aquatic habitat conditions.

## Water Quality

Water produced within the three national forests is generally of high quality. Monitoring programs include an extensive network of stream temperature sensor sites, sediment sampling in selected streams as part of project monitoring, and measurements of other water quality parameters. The most persistent and widespread water quality concern for all three national forests is high stream temperatures during low stream flows in summer. High summer air temperatures, changes in stream surface shading caused by Forest Service management activities, and low flows are important factors contributing to warmer water. Sediment levels in streams vary significantly with stream flows, with the highest levels during winter and spring runoff. Some stream reaches show evidence of sediment accumulation from varying sources, such as local stream bank erosion or contributing watershed conditions (e.g., high sediment-producing geology and roads close to streams). Sediment accumulation is a natural function in lower gradient streams, but some areas show evidence of sediment accumulation from past and ongoing management activities. Heavy metals and related acid discharges have been identified in streams in highly mineralized geologic zones with past and present mining activities. These areas include the Granite and Upper North Fork John Day River watersheds within the Wallowa-Whitman and

Umatilla National Forests and the Upper Middle Fork John Day River watershed within the Malheur National Forest. Other water quality concerns that have been observed include nutrient and bacteria sources from livestock, wildlife, and recreation uses. Impacts generally occur during times of concentrated use (at concentrated use areas).

Water quality has improved in recent years as a result of changes in management motivated by direction in PACFISH and INFISH, implementation of water quality best management practices (BMPs), direction in the Regional Aquatic Restoration Strategy, fish recovery plans, and through partner investments. Examples include increased emphasis on protecting streamside areas to reduce impacts to shade producing vegetation, repairing and removing unstable roads, and diverting acid mine discharge into off-stream settling ponds. At the project level, Forest Service staff design and implement a wide variety of BMPs as part of land management activities. Monitoring occurs on a sample of practices to determine BMP implementation and effectiveness and need for adjustment. For example, Umatilla National Forest personnel monitored salvage logging BMPs from 2006 through 2008 and reported adequate riparian areas, roads practices, and water quality protection. Monitoring of road decommissioning and stabilization conducted by the Rocky Mountain Research Station since 2008 has assessed treatment effectiveness in reducing impacts to aquatic ecosystems. Monitoring results indicated treatments reduced erosion and sediment delivery and lowered risk to aquatic ecosystems.

### *Impaired Waters*

Water quality is assessed in terms of designated beneficial uses as defined by the Oregon Department of Environmental Quality (ODEQ) and Washington Department of Ecology (WDOE). Under section 303(d) of the Clean Water Act, states, territories, and some American Indian tribes are required to develop lists of impaired waters which are submitted to Congress every two years. Streams that do not meet water quality standards and thereby do not protect designated beneficial uses are referred to as impaired and are included on state 303d lists. The law requires that states develop total maximum daily loads (TMDLs) for these waters that address the sources of pollution and identify actions needed to improve water quality. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards. TMDLs establish load allocations that are expected to provide conditions that meet state water quality standards over time.

ODEQ's 2004/2006 water quality assessment is used to compile the list of impaired waters for Oregon for use in this analysis. For streams in Washington, the listing of impaired waters as of 2008 is used in this analysis. For the Blue Mountains, for all ownerships in subbasins with National Forest System lands, about 4,500 miles of streams were identified on state 303d lists as water quality limited. About 1,240 miles (492 stream segments in Oregon and 5 segments in Washington), or one-third of impaired stream miles, are located within national forests (see table 140). This includes 464 miles within the Malheur National Forest, 326 miles within the Umatilla National Forest, and 454 miles within the Wallowa-Whitman National Forest. The most common water quality impairment in National Forest System lands is stream temperature. Other parameters for listing streams include sedimentation, turbidity, and nutrient, bacteria, and iron content. Because the concentration of dissolved oxygen in water is temperature dependent, streams with high water temperatures often have correspondingly low dissolved oxygen levels, which is detrimental to beneficial uses (cold water fish species).

**Table 140. Miles of water quality impaired (303(d)) stream by subbasin within each national forest as of 2004/2006 (OR) and 2008 (WA)**

| Subbasin | MAL | UMA | WAW | 303(d) Miles in NFS lands |
|---|---|---|---|---|
| 17050116 | 110 | NA | NA | 110 |
| 17050201 | NA | NA | 53 | 53 |
| 17050202 | NA | NA | 40 | 40 |
| 17050203 | NA | NA | 38 | 38 |
| 17060101 | NA | NA | 55 | 55 |
| 17060102 | NA | NA | 86 | 86 |
| 17060103 | NA | 7 (WA) | 12 | 19 |
| 17060105 | NA | NA | 62 | 62 |
| 17060106 | NA | 20 | 68 | 88 |
| 17070102 | NA | 22 | NA | 22 |
| 17070104 | NA | 1 | NA | 1 |
| 17070201 | 124 | NA | NA | 124 |
| 17070202 | 1 | 268 | 41 | 309 |
| 17070203 | 132 | 1 | NA | 134 |
| 17070204 | NA | 7 | NA | 7 |
| 17120001 | 13 | NA | NA | 13 |
| 17120002 | 33 | NA | NA | 33 |
| 17120004 | 52 | NA | NA | 42 |
| **Totals** | **464** | **326** | **454** | 1,244 |

For 303d-listed streams in National Forest System lands in the Blue Mountains, 59 percent of stream miles are listed due to stream temperature. Sources of temperature impairment identified in TMDLs by ODEQ and WDOE include loss of stream shade, changes in channel morphology, loss of floodplain and shallow groundwater connection, and changes in streamflow. Both agencies recognize that stream shade provided by riparian vegetation has the most widespread achievable effect on reducing stream temperatures by reducing direct solar radiation. This emphasis on shade shows the importance of restoring healthy communities of riparian vegetation. The agencies recognize that changes in channel morphology are often more costly and take longer to achieve results. Both states have administrative procedures for transferring water rights from out-of-stream uses to instream flows for benefit of water quality, aquatic species, and recreation uses.

As of 2010, ODEQ and WDOE have completed analysis of TMDLs and Water Quality Implementation Plans for the John Day, Upper Grande Ronde, Lower Grande Ronde, Tucannon, Walla Walla, Umatilla, Willow (Oregon), Malheur, and Snake River-Hells Canyon basins (see table 141).

**Table 141. Status of total maximum daily loads (TMDLs) and water quality restoration plans (WQRPs)**

| National Forest | Subbasin/ Watershed | Water Quality Concern Addressed | TMDL Parameters | TMDL Date | WQRP Date | WDOE or ODEQ Response/Approval |
|---|---|---|---|---|---|---|
| UMA | Lower Snake-Tucannon (WA) | Temperature | Temperature | 2010 | None | WDOE included federal land management requirements in streamlined process, FS not part of TMDL, provided data and comment |
| UMA | Walla Walla Basin (OR) | Temperature | Temperature | 2005 | 2007 | ODEQ provided comment on 303(d) listed (pre-TMDL) WQRP.<br>1 TMDL WQRP in preparation in cooperation with DEQ, TMDL completed |
| UMA | Umatilla River Basin (OR) | Temperature, pH, Sedimentation, Turbidity, Aquatic Weeds, Algae | Temperature, pH, Sedimentation, Turbidity, Aquatic Weeds, Algae | 2001 | None | No 303(d) listed (pre-TMDL) WQRP submitted. No WQRP implementation plan required, TMDL completed |
| UMA | Willow Creek Subbasin (OR) | Temperature, Bacteria, and pH | Temperature, Bacteria, and pH | 2007 | None | No WQRP submitted, TMDL completed |
| MAL UMA WAW | John Day Basin (OR) | Temperature, Bacteria, DO, and Excessive Amounts Of Fine-Grained Streambed Sediment. | Temperature, Bacteria, and DO | 2010 | In progress | No 303(d) listed (pre-TMDL). TMDL completed, WQRP in development. |
| MAL | Malheur River Basin and Middle Snake-Payette Subbasin (OR/WA) | Temperature, Bacteria, Chlorophyll-a, toxics, DDT, Dieldrin, and DO | Temperature, Bacteria, and Chlorophyll a (Controls on total phosphorus). | 2010 | In progress | TMDL completed, WQRP in development. |
| UMA WAW | Upper Grande Ronde Subbasin (OR) | Temperature, pH, Algae, DO, Sedimentation | Temperature, Sediment, Nitrogen, Phosphorous | 2000 | None | No 303(d) Listed (pre-TMDL) WQRP Submitted, TMDL Completed |
| UMA WAW | Lower Grande Ronde, Wallowa, Imnaha Subbasins | Temperature, Bacteria (E Coli and Fecal Coliform), pH, DO, and Sedimentation | Temperature, and Bacteria (E Coli and Fecal Coliform) | 2010 | None | No 303(d) listed (pre-TMDL) WQRP submitted. No WQRP TMDL Implementation Plan Required, TMDL Completed |
| WAW | Snake River/Hells Canyon (part 1) | Temperature, Total Dissolved Gas, DDT, DDE, DDD, Dieldrin | Temperature, Total Dissolved Gas, DDT, DDE, DDD, Dieldrin | 2004 | None | No WQRP Submitted, TMDL Completed |
| WAW | Snake River/Hells Canyon (part 2) | Phosphorus, Sediment and Dissolved Oxygen | Phosphorus, Sediment and Dissolved Oxygen | 2004 | None | No WQRP Submitted, TMDL Completed |
| WAW | Powder Basin, Brownlee Reservoir Subbasin | NA | NA | NA | NA | TMDL not started (minimal or no activity) |

The TMDL process was initiated in the Deschutes-Crooked, Burnt, Powder, and Brownlee subbasins in 2010 and has not yet been started for Silver Creek or the Silvies River. Completed TMDLs identify the sources of water quality impairment and the measures needed to restore water quality in each basin. The Forest Service has contributed to the development of TMDLs since 1998 by providing relevant data and technical assistance for streams within the Blue Mountains national forests and has participated in technical and stakeholder groups. As the designated management agency, the Forest Service is responsible for developing water quality implementation plans that outline the BMPs and restoration strategies needed to restore water quality in impaired waters and reduce pollution to surface waters in National Forest System lands. Watershed restoration plans are currently being implemented in 3 watersheds and 22 subwatersheds.

The majority of water bodies within the three national forests support designated beneficial uses, which include domestic and agricultural, cold-water fisheries, recreation, domestic livestock, and wildlife uses. Maintaining the quality of these waters is becoming increasingly important as the demand for clean water resources increases and the timing and volume of surface runoff changes in responses to climate change.

The ability to maintain existing high quality habitats and to restore degraded habitats will be influenced by climate change over the next several decades with projected higher average air temperatures, more winter precipitation falling as rain versus snow, and diminishing winter snow packs resulting in earlier snowmelt. Changes in runoff volume and lower summer base flows, higher surface water temperatures, and likely greater year-to-year variability in precipitation could also result in extended drought periods and more severe floods than have occurred in recent history. Changes in timing and amount of runoff associated with climate change affect every resource, including terrestrial vegetation, wildlife, riparian and aquatic species, and water availability for human use. The effects of climate change to water resources are further described in the discussion of cumulative effects.

### *Water Uses*

Water from the national forests is valued for many ecological, economic, and social purposes. Ecological values are described in the watershed function and water quality sections. Water uses are described in terms of consumptive and nonconsumptive uses for defined purposes recognized by federal and state agencies. For some American Indian tribes, water is considered a culturally significant food used for ceremonies and subsistence needs.

Within the national forests, water is used for a number of purposes including habitat for anadromous and resident fish species, domestic and municipal uses, commercial and industrial uses, Forest Service management, mining, irrigation, and other uses. By volume, the largest water uses are for instream flows for the maintenance of freshwater habitats, water quality or recreation (greater than 40 percent of total streamflow), and irrigation (20 percent). Instream water rights are held by several state agencies in Oregon and Washington.

Most of the water diverted within the national forests is used for agricultural uses on private lands downstream of National Forest System lands. Domestic and municipal water uses account for less than 2 percent of total water use. Out of 4,476 points of diversion within national forests in the Oregon portion of the Blue Mountains, 3,162 points of diversion (75 percent of Forest Service-owned water rights) provide water for domestic livestock and 737 points of diversion (16 percent of FS rights) are used to provide water for wildlife. For all subbasins in the Blue Mountains, groundwater accounts for less than 10 percent of total water withdrawals and 95 percent of withdrawals are for irrigation.

Storage water rights within the national forests total less than 120,000 acre-feet. For comparison, mountain snowpacks store an estimated 5.2 to 6.3 million acre-feet of water that is released during a roughly three to six month period between spring and mid-summer. The consumptive use of water for irrigated agriculture, primarily on lands downstream of the national forests, is approximately 1.3 million acre-feet per year, or about 18 percent of total runoff from all rivers in the Blue Mountains, with varying percentages of river volume between individual river basins.

Many communities in the Blue Mountains and surrounding areas rely on water from the national forests for their drinking water. National Forest System lands are the primary source of drinking water for the cities of Walla Walla, Pendleton, La Grande, Baker City, Long Creek, and Canyon City. Some communities have municipal water rights in National Forest System lands but currently use other sources. By state law in Oregon and Washington municipal water rights do not lapse for non-use, and communities retain the right to develop these sites in the future if they choose to do so.

Many smaller community or individual water systems have sources within National Forest System lands. In Oregon, there are 230 points of diversion within National Forest System lands and an additional 70 points outside National Forest System land but within the proclaimed boundaries of the national forests that provide water for domestic use. In the Washington portion of the Umatilla national forest, there are an additional 20 diversion points that provide water for domestic use. The majority of watersheds in National Forest System lands provide some water for domestic or municipal use.

In terms of numbers of points of diversion, the majority of federally owned water rights in National Forest System lands are used to supply water for domestic livestock. More water by volume, for existing water rights in National Forest System lands, is used to maintain instream flows to support anadromous and resident fish, water quality, or aesthetics than for any other use. In accordance with state laws instream water rights are held by state agencies in Oregon and Washington.

Of approximately 6,800 water rights within the national forests, 43 percent provide water for domestic livestock, 32 percent support instream flows, 9 percent provide water for wildlife, 5 percent support irrigation uses, and 3 percent (226 water rights) provide water for domestic and municipal uses. By volume, instream flows account for more than 75 percent of all water rights; irrigation water rights account for about 1 percent by volume; and less than 1 percent by volume is used for domestic human use. Water rights for livestock account for 43 percent of the points of diversion in National Forest System lands but use 2 percent of the total water volume of all water rights in National Forest System lands in the Blue Mountains (0.03 percent of total stream flow).

## Analysis Assumptions and Methods

### *Alternatives*

All alternatives include desired conditions for watershed function and water quality, as displayed in appendix A. Alternatives E and F include desired conditions for road density in watersheds with anadromous fish and bull trout. Allowed forage utilization by livestock varies by alternative. Livestock grazing would be most restricted in alternative C, because livestock use would not occur in watersheds with ESA listed fish species. Elements of the Aquatic and Riparian Conservation Strategy (USDA Forest Service 2008) (ARCS) are included in all action alternatives, but alternatives differ in their emphasis on riparian areas and level of watershed restoration. The ARCS as incorporated into the revised forest plans preserves elements of PACFISH and INFISH and is intended to provide for consistent management for the benefit of aquatic and riparian-dependent species across all national forests in the Pacific Northwest Region.

ARCS elements include:

- Riparian management areas
- Key watersheds
- Mid-scale, or watershed analysis
- Watershed restoration
- Monitoring

These elements are intended to work together to achieve a distribution of watershed conditions that are resilient to natural disturbance and that maintain, restore, and enhance habitat for resident and anadromous fish and other aquatic and riparian dependent organisms (USDA Forest Service 2008).

As described in the proposed action, desired conditions were developed specifically for riparian management areas, watersheds, stream channels, and aquatic habitats. Most desired conditions are intended to apply to all watersheds, although some desired conditions apply specifically to key watersheds. A subset of key watersheds are identified as a priority for restoration within each national forest, recognizing that limited restoration funding would be focused on the highest priority watersheds and essential work would continue until completed.

The intent of the ARCS is to accelerate improvement of watershed and aquatic/riparian conditions across the region by: (1) conducting new and ongoing management activities in a manner that, across broad scales, protects areas in good condition and allows for passive recovery of those that are degraded, and (2) actively restoring watershed conditions in high-priority areas by implementing integrated, strategically focused restoration treatments that facilitate the recovery of critical watershed processes (Sedell et al. 1997).

**Riparian management areas** are areas bordering perennial and intermittent streams, wetlands, and sensitive areas where the management emphasis is to maintain, restore, or enhance the ecological health of aquatic and riparian ecosystems. The complete definitions of riparian management areas and conditions where they are applied can be found in the glossary.

**Key watersheds** are subwatersheds, or groups of subwatersheds, selected to serve as strongholds for important aquatic resources or that have the potential to do so. Key watersheds have a combination of watershed, riparian and aquatic habitat conditions that support, or are capable of supporting, strong populations of one or more selected focal species (Chinook salmon, steelhead, inland redband trout, and bull trout). A subset of key watersheds are named as priority watersheds and are expected to be the focus of watershed-related restoration over the life of the revised forest plan. Additional details on the selection of key and priority watersheds and tables identifying key and priority watersheds on each national forest are located in appendix B.

**Mid-scale, or watershed analysis** is a process for identifying and characterizing the status and trends of key physical and ecological conditions and processes influencing aquatic and riparian ecosystems at watershed scales, identifying the primary management issues associated with those conditions, and identifying opportunities to address them. Watershed analysis is not a forest plan component, but is an important process for informing forest plan implementation, as it provides context for management activities. The results of watershed analysis are used to diagnose the status and trend of aquatic and riparian resources; tailor and/or refine broad-scale desired conditions to finer scales; establish watershed-scale objectives for aquatic and riparian resource management; identify key management needs and opportunities, including restoration; and develop local monitoring programs. Watershed analysis provides the basis for developing watershed restoration programs and implementing a diverse range of land management activities in a manner that protects and/or enables natural recovery of watershed conditions.

**Watershed restoration** is an integrated set of both passive and active measures intended to facilitate the recovery of the physical, biological, and chemical processes that promote the maintenance or recovery of riparian and aquatic ecosystem structure and function. Implementation of the watershed restoration element would be tiered to the Region 6 Aquatic Restoration Strategy (USDA Forest Service 2005), which uses a strategic, integrated, multi-scale approach to prioritize watershed restoration treatments. The highest priority is to first restore critical watershed processes in those areas where the structure and function of the aquatic ecosystem are largely intact, but are threatened by existing or projected watershed conditions. Watersheds with highly degraded aquatic ecosystems will be a lower priority for restoration until threats to existing strongholds (e.g., key watersheds) are mitigated.

The focus of restoration actions is to restore the processes responsible for creating and maintaining the landscape-scale diversity of aquatic and riparian habitats. Actions to accomplish this may include, but are not limited to:

- Altering the structure and composition of upland vegetation in order to move towards desired conditions, reduce wildfire risk, and restore resilience
- Increasing the diversity and complexity of aquatic and riparian habitats by promoting natural establishment and succession of riparian plant communities
- Restoring the natural range of stream flows to the greatest possible extent
- Reducing road-related erosion and sediment delivery to streams through road closure, road obliteration, improving maintenance, and/or improving erosion control
- Removing fish passage barriers that block or restrict access to historically occupied aquatic habitats or restrict connectivity between aquatic habitats
- Altering riparian habitats to favor deciduous trees and shrubs as appropriate and where such species were formerly abundant
- Reintroducing keystone species, such as beaver, into suitable habitats within their former range
- Designing watershed, riparian and aquatic habitat restoration projects that promote ecological function and the range of natural processes responsible for habitat formation
- Managing invasive species to maintain the composition and diversity of native species
- Adapting management actions to respond to the expected effects of climate change

**Monitoring** is a systematic, science-based process of collecting and analyzing information. There are three types of monitoring: implementation, effectiveness, and validation. Monitoring will determine whether management direction is being implemented, whether it is effective at achieving desired results, and the status and trends of particular ecological conditions or relationships. Monitoring is essential, as it provides the basis for determining whether forest plan components and/or their implementation need to be altered.

Appendix A includes a proposed framework for monitoring the revised forest plans. The components associated with watershed and aquatic resources are intended to do the following:

- At the project-scale, assess whether design criteria (standards and guidelines) are being implemented and are effective at achieving desired aquatic resource management objectives.
- At broader-scales, track the condition and trend of watersheds, aquatic and riparian habitats, water quality, and aquatic focal species and assess progress towards achieving or maintaining the associated desired conditions.
- Track implementation of proposed restoration actions and evaluate the effectiveness of those actions in improving watershed conditions, particularly in key and priority watersheds.
- Provide information on the effects of climate change on watershed resources, particularly changes in stream flows and stream temperatures.

Collectively, this multi-scale monitoring program is intended to facilitate management by providing relevant information over both short (i.e., years) and long (i.e., decadal or longer) timeframes. For example, in the short term, project-scale implementation and effectiveness monitoring will be used to evaluate whether more focus is needed to ensure standards and guidelines are being followed and/or whether they need to be modified to achieve desired conditions. Conversely, over longer timeframes, broader-scale status and trend information will be used to evaluate whether desired conditions, objectives, and/or land allocations require adjustment.

## Environmental Consequences – Watershed Function, Water Quality, and Water Uses

### Summary of Effects to Watershed Function, Water Quality, and Water Uses

This section introduces the environmental consequences of the alternatives and includes a general summary of broad scale effects and relative trends for the planning area followed by more detailed discussion of the effects of each alternative for each national forest. Site-specific outcomes to watershed function (hydrologic function, riparian and wetlands areas, streams, and aquatic habitat), water quality, and water uses from the alternatives are not predicable until mid-scale assessment and/or project level NEPA analysis is completed.

**Alternative A** would continue current management direction, which includes a mix of protection strategies and active watershed and vegetation management. Watershed restoration would proceed at current levels, though watershed restoration is not integral to forest plan direction as amended by PACFISH and INFISH. Current management direction includes forest and regional strategies for watershed protection and passive restoration. The emphasis on watershed protection and restoration would be slightly less than it would be for alternatives B, E, and F, and much lower than for alternative C, because of differences in the area of riparian habitat conservation areas (RHCAs) for intermittent streams in watersheds where no listed fish species are present and because projections for restoration are reduced. Over the life of the plan (10 to 15 years), watershed conditions would be maintained or improved at current rates. During the long term (greater than 20 years), watershed conditions would continue to improve but at slower rates (fewer watersheds in improving condition) compared to alternatives B, C, E, and F because of differences in protection and restoration levels as described in the details of the alternatives.

Protection of watershed-related resources in this and all other alternatives is implied by the width of riparian management areas (RMAs) or RHCAs, limitations on motor vehicle use, road construction and other land disturbing actions, and the extent of management areas in which land disturbing activities would be limited.

**Alternatives B, C, E, and F** include planning area wide strategies for watershed protection and active restoration that would likely result in accelerated improvement in watershed condition and in the maintenance and improvement of lakes, streams, and rivers, though at varying rates, during the short and long terms. These alternatives include consistent direction for intermittent streams across all watersheds.

**Alternative B** includes a mix of protection and restoration proposals that would improve watershed conditions and water quality more than alternative A but less than alternatives C, E, and F during the short and long terms because of slightly lower projections for protection and restoration.

**Alternative C** would have the greatest level of watershed restoration and the largest contiguous areas of limited motor vehicle use. Alternative C would result in the greatest improvement in watershed condition during the short and long terms, in large part, because active restoration of riparian and aquatic habitats would be higher than in all other alternatives. This alternative would provide a greater level of protection (wider riparian management areas) and less active management (vegetation, grazing, motorized recreation). During the long term there would be an increased risk of disturbance associated with limited active vegetation treatment particularly in dry forest types, potentially reducing benefits to watershed condition.

**Alternative D** would emphasize commodity production and would have the lowest levels of watershed protection and restoration of hydrologic and riparian function. It would have the highest level of active vegetation management. Improving vegetation resilience would contribute to improving watershed condition but would likely result in a declining trend in overall watershed improvement and a potential for degradation of watershed condition, water quality, and soil quality in some areas because of relatively high objective levels for timber harvest, road use, and livestock grazing. Although upland vegetation conditions would improve at the fastest rate, this alternative would have the greatest short and long term risks to watershed function and water quality.

**Alternatives E and F** include a mix of watershed protection and active restoration that would, during the short term, improve watershed conditions more than alternatives B and D, but less than alternative C. These alternatives include desired conditions for reduced road density in anadromous and bull trout watersheds and specific guidelines for range management that would, during the long term, also contribute to improving trends in watershed condition and water quality in affected watersheds. Alternative E would provide greater emphasis on vegetation restoration and, during the short term, pose slightly greater risk to watershed conditions (less than alternative D but more than the other action alternatives). During the long term, both alternatives would improve watershed conditions and water quality at a slightly lower rate than alternative C because of the levels of protection and amount of active restoration, including vegetation and roads activities.

**All action alternatives** include key and priority watersheds as a basis for watershed protection and restoration, but effects to watershed function and water quality would vary in these areas because of different mixes of management area allocations, suitability, access (roads and trails), and other management activities. All alternatives would include water quality BMPs for protection and restoration of water quality as part of project level design criteria. Water quality BMPs would be applied in all watersheds but effectiveness would vary because of differences in riparian protection and activity levels. Short term refers to the life of the plan, or 10 to 20 years, and long term refers to effects beyond the life of the plan, or beyond 20 years, and assumes the alternative intent would continue into the future.

Effects of the alternatives are described in the following order:

- Upslope conditions within watersheds are described in terms of expected changes in the condition of forested vegetation, hydrological connectivity of the road system, and grazing use intensity
- Differences in the effects of grazing on riparian habitats between alternatives
- Influence of differences in riparian habitat conservation areas (RHCAs) and riparian management areas
- Influence of restoration actions on riparian, stream channel, and aquatic habitat conditions
- Extent of detrimental soil conditions resulting from expected levels of timber harvest
- Changes in overall watershed conditions, considering all of the above factors

## Comparison of Alternatives

### *Malheur National Forest*

**Key Indicator:** Vegetation condition

The percent area and average departure score of each of the three dominant forested potential vegetation groups within the Malheur National Forest are displayed in table 142. Dry forest accounts for 72 percent of the Malheur National Forest and is the most departed from the historical range of variability.

**Table 142. Percent of national forest and average fire regime condition class departure score by potential vegetation group for the Malheur National Forest**

| Potential Vegetation Group | Percent of MAL | Average Fire Regime Condition Class Departure |
|---|---|---|
| Dry forest | 72% | 62 |
| Moist forest | 6% | 36 |
| Cold forest | 9% | 54 |

From an analysis of vegetation data aggregated for all potential vegetation groups for the Malheur National Forest, 43 of 143 subwatersheds have vegetation that is slightly departed from HRV, 58 subwatersheds have vegetation that is moderately departed from HRV, and vegetation in 42 subwatersheds is highly departed from HRV. The expected change in vegetation condition is based on the modeled change in departure scores of the three dominant forest potential vegetation groups and is expressed as the change in departure scores at years 10 and 20. All of the values in table 143 represent the degree of change towards HRV, or improved vegetation condition. Alternative D, for example, would result in a 7.5 percent change in departure (towards HRV) at year 10 and 14.9 percent change at year 20. Based on the analysis of forested vegetation, alternative D would result in the greatest improvement in forested vegetation condition and alternative C the least.

**Table 143. Percent change from existing condition in average forested vegetation departure score for each alternative for the Malheur National Forest**

| Timeframe | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| At year 10 | 4.4% | 5.0% | 4.1% | 7.5% | 6.3% | 5.2% |
| At year 20 | 8.8% | 9.9% | 8.1% | 14.9% | 12.6% | 10.3% |

Adjusting the departure scores for forested vegetation in each subwatershed on the Malheur National Forest by the values in table 143 results in an improvement in vegetation conditions at year 10 and at year 20 as displayed in table 144 and table 145. The tables display the number of subwatersheds in each of the three condition classes by alternative compared to the existing condition. The change, or improvement, in vegetation departure score is applied to all watersheds and represents the average condition, even though it is likely that actual vegetation conditions will vary throughout the national forest.

**Table 144. Forested vegetation condition classes and number of subwatersheds in each class at year 10 for each alternative for the Malheur National Forest**

| Forested Vegetation Condition Class | Existing Condition | Alt. A Yr. 10 | Alt. B Yr. 10 | Alt. C Yr. 10 | Alt. D Yr. 10 | Alt. E Yr. 10 | Alt. F Yr. 10 |
|---|---|---|---|---|---|---|---|
| 1 | 43 | 59 | 69 | 59 | 82 | 77 | 69 |
| 2 | 58 | 65 | 55 | 61 | 48 | 52 | 55 |
| 3 | 42 | 19 | 19 | 23 | 13 | 14 | 19 |

**Table 145. Forested vegetation condition classes and number of subwatersheds in each class at year 20 for each alternative for the Malheur National Forest**

| Forested Vegetation Condition Class | Existing Condition | Alt. A Yr. 20 | Alt. B Yr. 20 | Alt. C Yr. 20 | Alt. D Yr. 20 | Alt. E Yr. 20 | Alt. F Yr. 20 |
|---|---|---|---|---|---|---|---|
| 1 | 43 | 87 | 101 | 87 | 126 | 116 | 101 |
| 2 | 58 | 45 | 31 | 43 | 15 | 24 | 32 |
| 3 | 42 | 11 | 11 | 13 | 2 | 3 | 10 |

At year 10 and at year 20, alternative D would result in the greatest improvement in forested vegetation condition, and would result in the most watersheds with vegetation in the least departed condition (Condition Class 1) and the fewest in the most departed state (Condition Class 3). Alternatives A and C would result in the fewest watersheds with forested vegetation in the least departed condition and the highest number (11 and 13, respectively) in the most departed condition. Alternative E would result in the second highest number of watersheds with vegetation in the least departed condition, followed by alternatives B and F.

The condition of forested vegetation in priority watersheds, the watersheds in which restoration actions are expected to be focused, is displayed in table 146 (at year 10) and table 147 (at year 20). Improved conditions are reflected by more watersheds in condition class 1 for all alternatives, relative to existing conditions. At year 10, the number of watersheds in condition class 1 would be the same for alternatives B, D, E, and F. For alternative D, modeling shows all 26 priority watersheds would potentially have vegetation in condition class 1 at year 20.

Alternatives A and C would result in the fewest number of priority subwatersheds in condition class 1 at year 20 (19 each).

**Table 146. Forested vegetation condition classes and number of priority watersheds in each class at year 10 for each alternative for the Malheur National Forest**

| Forested Vegetation Condition Class | Existing Condition | Alt. A Yr. 10 | Alt. B Yr. 10 | Alt. C Yr. 10 | Alt. D Yr. 10 | Alt. E Yr. 10 | Alt. F Yr. 10 |
|---|---|---|---|---|---|---|---|
| 1 | 12 | 15 | 18 | 15 | 18 | 18 | 18 |
| 2 | 8 | 11 | 8 | 11 | 8 | 8 | 8 |
| 3 | 6 | 0 | 0 | 2 | 0 | 0 | 0 |

**Table 147. Forested vegetation condition classes and number of priority watersheds in each class at year 20 for each alternative for the Malheur National Forest**

| Forested Vegetation Condition Class | Existing Condition | Alt. A Yr. 20 | Alt. B Yr. 20 | Alt. C Yr. 20 | Alt. D Yr. 20 | Alt. E Yr. 20 | Alt. F Yr. 20 |
|---|---|---|---|---|---|---|---|
| 1 | 12 | 19 | 20 | 19 | 26 | 24 | 20 |
| 2 | 8 | 7 | 6 | 7 | 0 | 2 | 6 |
| 3 | 6 | 0 | 0 | 0 | 0 | 0 | 0 |

**Key Indicator:** Roads

Two measures of roads, total road density and hydrologically connected roads are used in this analysis. Within the 143 subwatersheds modeled for the Malheur National Forest, there are 10,990 miles of existing roads and an average road density of 4.2 miles per square mile. The 26 priority watersheds within the Malheur National Forest contain 3,151 existing road miles and have an average road density of 4.8 miles per square mile. An estimated 4,798 miles of hydrologically connected roads occur within the national forest, including 1,454 miles in priority watersheds. In this analysis, road density is assumed to be constant between alternatives. Some road decommissioning or obliteration is expected to occur for each of the alternatives, but the miles of road to be decommissioned cannot be predicted at this time. The focus of this analysis is on the treatment of hydrologically connected roads in priority watersheds.

The objectives for road related restoration and the percentage of hydrologically connected roads in priority watersheds that this represents are displayed in table 148. Road treatments are expected to be completed with 10 years.

**Table 148. Roads treatment objectives (miles) and percent of hydrologically connected roads that would be treated in priority watersheds for the action alternatives for the Malheur National Forest**

| Roads Treatment Objective (first decade) | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|
| Roads that would be treated (miles) | 260 | 600 | 650 | 290 | 310 |
| Percent of priority watersheds | 17.9% | 41.3% | 44.7% | 19.9% | 21.3% |

The emphasis of road related treatment objectives, as stated in appendix A, is to reduce road related sedimentation in streams by reducing the hydrological connectivity of National Forest System roads. Comparing the objective levels to the estimated 1,454 miles of hydrologically connected roads, approximately 45 percent would be treated for alternative D and 18 percent for alternative B, Forty-one percent would be treated for alternative C, and approximately 20 percent each for alternatives E and F.

The existing road system extends the channel network in priority watersheds by as much as 93 percent, suggesting a relatively large increase in the rate of watershed runoff caused by forest roads (Wemple et al. 1996). Hydrologic extension of the channel network due to National Forest System roads would be reduced to 52 percent, 55 percent, 73 percent, 75 percent, and 77 percent for alternatives D, C, F, E, and B respectively. The hydrologic connectivity of the road system would be substantially reduced for alternatives C and D and only somewhat reduced for the other action alternatives. The extent of channel network extension due to the road system would exceed 50 percent for all action alternatives and would still be considered high as reflected in the roads condition classes displayed in table 149 and table 150.

**Table 149. Hydrologically connected roads condition classes and number of priority watersheds in each class for the action alternatives for the Malheur National Forest**

| Hydrologically Connected Roads Condition Class | Existing Condition | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 3 | 3 | 1 | 1 |
| 2 | 0 | 3 | 5 | 6 | 3 | 3 |
| 3 | 26 | 23 | 21 | 20 | 23 | 23 |

Because existing road density in priority watersheds is high and is assumed to change very little in this analysis, the change in hydrologically connected roads contributes little to improving watershed condition. The hydrological condition of most priority watersheds would continue to be strongly affected by National Forest System roads (see table 150).

**Table 150. Total roads condition classes and number of priority watersheds in each class for the action alternatives for the Malheur National Forest**

| Total Roads Condition Class* | Existing Condition | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 0 | 1 | 2 | 3 | 1 | 1 |
| 3 | 26 | 25 | 24 | 23 | 25 | 25 |

* The total roads condition class is based on both road density and hydrologically connected roads.

**Key Indicator:** Livestock grazing

Eighty-one percent of the Malheur National Forest is presently considered suitable for grazing by cattle or sheep. Active allotments cover 92 percent of the national forest's area. Acres suitable for domestic livestock would be essentially the same for alternatives A, B, D, E, and F. Suitable acres would be 50 percent less for alternative C. There would be 126,500 cattle and sheep animal unit months (AUMs) in alternative B; 125,500 AUMs for alternative D; and 123,500 AUMs in alternatives A, E, and F. There would be 50 percent less AUMs for alternative C (62,200). The change in AUMs is used to recalculate relative forage use intensity by alternative and is assumed to change in all watersheds for the purpose of this analysis.

The difference in grazing use is used to project use intensity for the alternatives in each watershed within the national forest. The calculation of forage use in this analysis assumes that all areas of an allotment could be used by domestic livestock. Forage production in areas known to be unsuitable is given a nominal value of 50 pounds per acre per year so that most of the use is accounted for by acres that are suitable for domestic livestock. The resulting average use intensity for all 143 subwatersheds and in priority watersheds only is displayed in table 151. Calculated for existing conditions, 11 of 143 subwatersheds have apparent use intensity greater than 40 percent, the level proposed by Holechek et al. (2006) below which adverse effects to forage species can be avoided. Average use levels are expected to be nearly the same for alternatives A, B, D, E, and F. Average forage use intensity would be 3.2 percent in alternative C, and the greatest calculated forage use intensity in any single subwatersheds would be less than 16 percent.

**Table 151. Average percent forage use intensity in all watersheds and in priority watersheds for each alternative for the Malheur National Forest**

| Watershed | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| All watersheds | 15.9% | 15.9% | 3.8% | 17.0% | 15.9% | 15.9% |
| Priority watersheds | 13.6% | 13.6% | 3.2% | 14.5% | 13.6% | 13.6% |

Table 152 displays the condition class based on upland forage use intensity alone for watersheds in the Malheur National Forest. The number of priority watersheds in each condition class based on upland forage use intensity alone is displayed in table 153.

**Table 152. Rangeland condition classes (based on upland forage use intensity) and number of watersheds in each class for each alternative for the Malheur National Forest**

| Rangeland Condition Class | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| 1 | 78 | 78 | 140 | 76 | 78 | 78 |
| 2 | 41 | 41 | 3 | 36 | 41 | 41 |
| 3 | 24 | 24 | 0 | 31 | 24 | 24 |

**Table 153. Rangeland condition classes (based on upland forage use intensity) and number of priority watersheds in each class for each alternative for the Malheur National Forest**

| Rangeland Condition Class | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| 1 | 14 | 14 | 26 | 13 | 14 | 14 |
| 2 | 10 | 10 | 0 | 8 | 10 | 10 |
| 3 | 2 | 2 | 0 | 5 | 2 | 2 |

The number of subwatersheds with the lowest relative use intensity (subwatersheds in rangeland condition class 1) would be nearly equal for alternatives A, B, D, E, and F. This is true for all watersheds within the national forest, including priority watersheds. For alternative C, all priority watersheds and nearly all other watersheds would be expected to be in condition class 1, reflecting the lowest upland forage use intensity.

Livestock use of riparian areas is generally believed to be greater than use of uplands unless specific measures (herding, off-channel water sources, fencing, etc.) are implemented (Clary and Webster 1990, Fleischner 1994, Bengeyfield 2006). Livestock forage use in riparian areas was estimated for the existing condition, but not for each alternative in this analysis. Instead, a comparison is made of allowable forage utilization in riparian areas (see table 154).

Differences in livestock use between alternatives would also be reflected in changes in forage use intensity in riparian areas. The largest relative reduction of livestock use in riparian areas would occur for alternative C due to reductions in stocking levels permitted with that alternative.

For alternatives B and D, utilization of woody riparian species and herbaceous vegetation would be limited to 40 percent of annual growth. The same limits would apply for alternatives E and F, with the exception that utilization limits would be lower in watersheds inhabited by bull trout, and alternative F would have slightly lower utilization limits in watersheds inhabited by anadromous fish. The stricter guidelines in alternatives E and F would apply in 16 subwatersheds containing bull trout (279,000 acres or 16 percent of the national forest) and 44 subwatersheds inhabited by anadromous salmon or steelhead (490,000 acres or 29 percent of the national forest). It is expected that lower utilization of riparian vegetation in alternatives E and F would result in a greater improvement in riparian conditions relative to alternatives B and D.

**Table 154. Maximum utilization and minimum residual stubble height within riparian areas (appendix A, MA4B RMA-RNG-2-G115)**

| Measure | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|
| Maximum percent utilization of woody vegetation (percent of mean annual vegetative production) | 40% | 25% | 40% | 25% within bull trout spawning and rearing reaches<br>40% for all other watercourses including anadromous fish reaches | 25% within bull trout spawning and rearing habitat (all three national forests)<br>35% in anadromous fish reaches (UMA and WAW)<br>40% outside bull trout spawning and rearing habitat (MAL)<br>40% outside anadromous fish reaches (UMA and WAW) |
| Maximum percent utilization of herbaceous vegetation | 40% | 10% | 40% | 25% within bull trout spawning and rearing reaches<br>40% for all other watercourses including anadromous fish reaches | 25% within bull trout spawning and rearing habitat (all three national forests)<br>35% in anadromous fish reaches (UMA and WAW)<br>40% outside bull trout spawning and rearing habitat (MAL)<br>40% outside anadromous fish reaches (UMA and WAW) |

* In addition, the minimum stubble height (applies at the greenline) for all alternatives is 4 to 6 inches. The maximum bank alteration for all alternatives is 20 percent.

**Key Indicator:** Riparian habitat conservation area (RHCA) and riparian management area (RMA) acres

Present management of riparian areas under PACFISH (USDA and USDI 1995) and INFISH (USDA Forest Service 1995) includes the designation of riparian habitat conservation areas (RHCAs). RHCAs are portions or zones of watersheds where riparian-dependent resources receive primary emphasis. The zones have varying widths: 300 feet on either side of fish-bearing streams and permanently flowing non-fish-bearing streams; 150 feet from ponds, lakes, reservoirs and wetlands larger than one acre; and 100 feet if listed fish are present from seasonally flowing streams, wetlands smaller than one acre, landslides, and landslide-prone areas (50 feet if listed fish are not present).

Riparian management areas for alternatives B, E, and F would use the same basic definitions as RHCAs to define extent. RMAs are designated as management areas where specific desired conditions, standards, and guidelines apply. Riparian goals in PACFISH and INFISH are rearticulated as desired conditions for the action alternatives. RMA widths and extent are similar to RHCAs except that a width of 100 feet would apply to all seasonally flowing streams and small wetlands, whether or not the streams are fish bearing. The management of RMAs and RHCAs would be similar in that work within RMAs would have to show progress towards desired conditions, and any management activity conducted within RMAs would have to be designed specifically for the benefit of aquatic and riparian-dependent resources, whereas management of RHCAs currently requires that attainment of riparian management objectives not be retarded (USDA Forest Service 1995).

The acres of RHCAs (alternative A) and RMAs (all action alternatives) and the minimum percent of national forest area are displayed in table 155.

**Table 155. RMA acres and percent of Malheur National Forest for each alternative (RHCAs for alternative A)**

| Alt. A RHCAs acres (%) | Alt. B RMAs acres (%) | Alt. C RMAs acres (%) | Alt. D RMAs acres (%) | Alts. E and F RMAs acres (%) |
|---|---|---|---|---|
| 168,545 (10%) | 192,910 (11%) | 368,998 (22%) | 83,078 (5%) | 192,910 (11%) |

RMA acres would be greatest for alternative C, which would have 300-foot wide buffers for all streams, regardless of class. Alternative D would have the least acres within RMAs because RMA widths would be the narrowest for streams in all classes. RMA widths for alternative D are based on Oregon Forest Practices guidelines, which do not require RMAs for the smallest non-fish-bearing streams with average annual flow of less than 2 cubic feet per second. A review by the Independent Multidisciplinary Science Team (IMST 1999) of the RMAs required by the Oregon Forest Practices Act found that RMAs required by the act were insufficient to protect aquatic habitats because they were not applied to all streams and specifically not to non-fish-bearing streams. However, alternative D, as currently designed, would apply RMAs to intermittent and seasonally flowing streams and therefore would exceed the requirements of the Oregon Forest Practices Act.

Some reviews of the effectiveness of riparian buffers have concluded that widths of 300 feet, or one site-potential tree, are required in order to protect all of the desired functions of riparian areas (Wenger 1999). A review by Castelle and Johnson (2000) suggests that riparian buffer widths of 5 to 15 meters (16 to 49 feet) are sufficient to provide 50 to 75 percent of desired riparian functions, which include sediment filtration, stream temperature moderation, inputs of large organic debris, production of fine particulate organic matter, and stream bank stability. Castelle and Johnson (2000) found that most of the influence on stream bank stability was provided by fine roots within the bank itself. A study by Lakel et al. (2010) conducted in the Virginia Piedmont indicated that undisturbed riparian strips 50 feet wide were capable of trapping 97 percent of eroded sediment as long as flow was not channelized. Tang and Montgomery (1995) suggest that riparian buffers 100 meters wide would include 75 to 90 percent of potentially unstable ground in watersheds within the Olympic Peninsula in Washington. Lastly, a review by Pollock and Kennard (1998) concluded that buffer widths of 50 to 250 feet should be sufficient to provide most, if not all, of the desired functions of riparian areas in watersheds in eastern Washington.

Based on these reviews of effectiveness, the RMAs proposed for alternatives B, E, and F should be protective of most riparian functions. It is expected that RMAs will be delineated during project level planning and will identify areas of potentially unstable ground for inclusion within RMAs. The RMAs proposed for alternative C would likely be the most protective of unstable areas, as described by Tang and Montgomery (1995). The RMAs proposed for alternative D would be the least protective and may not be as efficient as the RMAs in all other alternatives at preventing sediment delivery to streams or providing for inputs of large organic debris but may still provide most other functions desired of RMAs.

**Key Indicator:** Number of wetland sites improved

Wetlands in National Forest System lands occur in a variety of settings, not all of which are associated with streams or rivers. Based on maps compiled by the U.S. Fish and Wildlife Service and provided to the National Wetland Inventory (NWI), off-channel and isolated wetlands comprise an area that is 40 percent or more of all wetlands within the Malheur National Forest. According to these maps, there potentially are more than 2,000 small wetlands within the Malheur National Forest, although the accuracy of the maps is not yet determined. These wetlands are an important component of the hydrology of watersheds within the national forest but are disproportionately important, relative to their size, as habitat for a variety of plant and animal species, and, in some cases, include species that occur only in specific wetland types. The objective for improvements to or restoration of a small number of these sites each year is included in each alternative and is displayed in table 156. Potential actions include vegetative restoration, hydrologic restoration, and protection by fencing.

**Table 156. Objective for wetland site restoration for the action alternatives for the Malheur National Forest**

| Wetland Site Restoration Objective (first decade) | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|
| Number of sites | 20 | 30 | 30 | 30 | 30 |

**Key Indicator:** Riparian and stream channel restoration

Within priority watersheds in the Malheur National Forest, there are approximately 424 miles of perennial streams or an average of 16.3 miles in each of 26 subwatersheds. The objectives for riparian restoration for the action alternatives range from 300 to 600 miles during the first decade of the plan period (see table 157).

**Table 157. Objective for riparian area improvement (miles) and percent of priority watershed miles that would be improved for the action alternatives for the Malheur National Forest**

| Riparian Area Improvement Objective (first decade) | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|
| Riparian area improvement in miles | 300 | 600 | 300 | 450 | 400 |
| Percent of riparian miles that would be improved (priority watersheds) | 71% | 142% | 71% | 106% | 94% |

The objective levels for alternatives C and E are higher than the sum of perennial stream miles in priority watersheds by 158 miles and 26 miles, respectively. It is assumed that additional riparian habitat would be treated in key watersheds, so some improvement in riparian conditions would occur outside priority watersheds. It is also likely that not all riparian habitats are in need of active restoration, so the objective levels stated for each action alternative may exceed the need in priority watersheds, which would result in restoration work being accomplished outside of priority watersheds.

Accomplishing the objectives for stream miles improved would potentially include the reconnection of streams and floodplains, stabilizing stream banks, restoring channel morphology, and the addition of large wood in streams. Because channel reconstruction is costly to design and implement, the number of miles completed in any year will vary and usually is small. However, there are a variety of actions or methods that could be used to improve stream channel and aquatic habitat conditions in lieu of channel reconstruction. The objective miles expected to be completed during the first decade of the plan period and the percentage of perennial stream miles in priority watersheds that those objectives represent are displayed in table 158.

**Table 158. Anticipated stream channel restoration (miles) in priority watersheds and percent that would be improved for the action alternatives for the Malheur National Forest**

| Stream Channel Restoration Objective (first decade) | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|
| Stream channel restoration (miles) | 25 | 40 | 25 | 38 | 35 |
| Percent of stream miles that would be improved | 5.9% | 9.4% | 5.9% | 9.0% | 8.3% |

It is likely that stream channel restoration would occur through a variety of activities in addition to physical channel reconstruction. Other actions could include placement of large wood, reconnection of side channels, conversion of water rights to restore or protect instream flows, and reintroduction of beaver to suitable sites. Replacement or removal of culverts that block access to potential habitat is also expected to occur. Redesign of road-stream crossings is also likely to contribute to improved channel and habitat conditions, both upstream and downstream of these sites. The stream miles displayed in table 158 are much lower than total stream miles in priority watersheds, but it is likely that only a small percentage of stream channels are in actual need of this kind of restoration. Improvements to stream channel conditions would also occur in response to expected improvements in upland and riparian conditions but may take some time to be realized. Active channel restoration is expected to occur for 6 to 9 percent of stream miles in priority watersheds, depending in the alternative selected. The fewest stream miles would be restored for alternatives B and D and the most for alternatives C and E.

**Key indicator:** Watershed condition class: number of watersheds in improved condition

The combined effect of vegetation condition, roads, and livestock use intensity are the factors used to represent upslope condition in watersheds. For this part of the analysis only, the number of watersheds in each condition class for alternative A at 10 years is used as the baseline condition as forested vegetation conditions are expected to improve regardless of the alternative selected. Improvements to upland conditions will eventually contribute to improved conditions in riparian and aquatic habitats by moderating watershed hydrology, reducing the rate of watershed runoff, and reducing sediment delivery to streams.

The influence of restoration of riparian, stream channel and aquatic habitat is not represented in the following tables, but is expected to contribute substantially to overall watershed conditions. The influence of these actions on watershed conditions as displayed in the following tables will be described separately.

**Table 159. Watershed condition classes and subwatersheds in each class along with subwatersheds improved at year 10 for each alternative for the Malheur National Forest**

| Watershed Condition Class | Alt. A Yr. 10 | Alt. B Yr. 10 | Alt. C Yr. 10 | Alt. D Yr. 10 | Alt. E Yr. 10 | Alt. F Yr. 10 |
|---|---|---|---|---|---|---|
| 1 | 16 | 20 | 22 | 20 | 21 | 21 |
| 2 | 30 | 42 | 66 | 44 | 46 | 46 |
| 3 | 97 | 81 | 55 | 79 | 76 | 76 |
| Subwatersheds improved | NA | 16 | 42 | 18 | 21 | 21 |

**Table 160. Watershed condition classes and priority watersheds in each class along with priority watersheds improved at year 10 for each alternative for the Malheur National Forest**

| Watershed Condition Class | Alt. A Yr. 10 | Alt. B Yr. 10 | Alt. C Yr. 10 | Alt. D Yr. 10 | Alt. E Yr. 10 | Alt. F Yr. 10 |
|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 2 | 8 | 13 | 10 | 10 | 10 |
| 3 | 24 | 18 | 13 | 16 | 16 | 16 |
| Priority watersheds improved | NA | 6 | 11 | 8 | 8 | 8 |

For all watersheds within the Malheur National Forest (see table 159), the largest change in the number of watersheds in improved condition class would occur for alternative C and would be driven by the large decrease in allowable AUMs, the higher rate of road treatments (relative to all other alternatives except D), as well as the fact that the rate of improvement in vegetation conditions is still expect to contribute to improved watershed conditions. The difference in number of watersheds improved between alternatives C and D would be largely due to the reduced livestock use intensity for alternative C and slightly higher use intensity for alternative D. Although there would be improvements in condition of priority watersheds, none would be in condition class 1 in any alternative after 10 years, and the majority of priority watersheds would remain in condition class 3. This would be primarily due to the existing high road densities and extent of hydrologically connected roads in these watersheds.

Continued improvement in the condition of forested vegetation through year 20 would increase the number of watersheds with good vegetative conditions and the number of watersheds in improved condition. The number of watersheds in good condition would increase between years

10 and 20 from 20 to 31 for alternative D, and from 22 to 32 for alternative C. The number of watersheds in improved condition would increase from 42 to 83 for alternative C and 18 to 47 for alternative D, and would increase for all alternatives. Alternative C would have the fewest watersheds (14) in condition class 3 at year 20 and all other alternatives would result in 50 or more of the 143 watersheds within the national forest in condition class 3.

There would be a small increase in the number of priority watersheds in good condition at year 20 compared to year 10. One watershed for alternative B and two each for all other action alternatives would be in condition class 1 at year 20 compared to none at year 10. The number of priority watersheds in condition class 3 would decrease from 13 at year 10 to 4 at year 20 for alternative C and from 16 to 9 for alternative D. The distributions of watersheds by condition class would be similar at year 20 for alternatives B, E, and F, with one or two watersheds in condition class 1 and 10 to 14 watersheds in condition class 3.

**Table 161. Watershed condition classes and subwatersheds in each class along with subwatersheds improved at year 20 for each alternative for the Malheur National Forest**

| Watershed Condition Class | Alt. A Yr. 20 | Alt. B Yr. 20 | Alt. C Yr. 20 | Alt. D Yr. 20 | Alt. E Yr. 20 | Alt. F Yr. 20 |
|---|---|---|---|---|---|---|
| 1 | 25 | 26 | 32 | 31 | 30 | 27 |
| 2 | 55 | 59 | 97 | 62 | 61 | 60 |
| 3 | 63 | 58 | 14 | 50 | 52 | 56 |
| Subwatersheds improved | NA | 39 | 83 | 47 | 45 | 41 |

**Table 162. Watershed condition classes and priority watersheds in each class along with priority watersheds improved at year 20 for each alternative for the Malheur National Forest**

| Watershed Condition Class | Alt. A Yr. 20 | Alt. B Yr. 20 | Alt. C Yr. 20 | Alt. D Yr. 20 | Alt. E Yr. 20 | Alt. F Yr. 20 |
|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 2 | 2 | 2 | 2 |
| 2 | 12 | 11 | 20 | 15 | 14 | 12 |
| 3 | 14 | 14 | 4 | 9 | 10 | 12 |
| Priority watersheds improved | NA | 10 | 20 | 15 | 14 | 12 |

These results are tempered by the projection that the area of detrimental soil conditions during the first decade of the plan period for alternative D would be greater than for alternative C by nearly 18,000 acres as a result of the levels and types of vegetation management activities that are expected to occur (see table 163). The acres of detrimental soil conditions would be lowest for alternatives C (5,030 acres) and B (7,490 acres) and highest for alternatives D (22,700 acres) and E (15,230 acres). Soil compaction and loss of ground cover influence hydrologic conditions in watersheds and increase the potential for surface soil erosion. Sites of detrimental soil disturbance represent an increased risk of sediment delivery to streams when the sites occur near streams or near hydrologically connected roads. Objectives for improving soil hydrologic function in areas disturbed by management activities would be less than the acres of new disturbance for all alternatives except alternative C. Without additional actions to protect or improve soil conditions, implementing alternatives B, D, E, and F would increase the area of detrimental soil conditions by approximately 3,000, 18,700, 9,200, and 5,300 acres respectively during the first decade of the plan period.

**Table 163. Acres of detrimental soil conditions and acres improved (treated) at year 10 for each alternative for the Malheur National Forest**

| Soil Condition | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| Area disturbed | 8,530 | 7,490 | 5,030 | 22,700 | 15,230 | 10,720 |
| Area improved (treated) | NA | 4,500 | 8,000 | 4,000 | 6,000 | 5,400 |

The acres of detrimental soil conditions combined with expected riparian and aquatic habitat restoration activities support that alternative C would result in the greatest improvement in watershed conditions while the least overall improvement in watershed conditions would occur for alternative D.

The difference in grazing use intensity based on differences in allowable AUMs would result in the greatest reductions in livestock use intensity for alternative C. Grazing effects for all other alternatives would be similar to the existing condition. The same relative differences in grazing use intensity would occur in upland as well as riparian habitats. Alternatives E and F would have livestock stocking levels the same as the existing condition but would implement stricter riparian utilization guidelines that would be expected to result in greater improvement in the condition of riparian habitats, including riparian shrubs.

Active restoration of riparian habitats would improve the condition of a higher percentage of riparian habitats for alternative C than for any of the other alternatives. The least improvement would occur for alternatives B and D.

Monitoring data collected for the PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program (PIBO) appears to show that riparian and aquatic habitat conditions in National Forest System lands in the Blue Mountains have improved since implementation of PACFISH and INFISH. Since the inception of monitoring in 2001 and based on repeat sampling of the sites through 2010, 8 of 13 habitat indicators and 9 of 11 vegetation indicators appear to be showing favorable, or upward, trends in condition. This trend is expected to continue for all alternatives, but would likely be strongest for alternative C and weakest for alternative D.

### *Umatilla National Forest*

Effects of the alternatives are described in the following order:

- Upslope conditions within watersheds are described in terms of expected changes in the condition of forested vegetation, hydrological connectivity of the road system, and grazing use intensity
- Differences between alternatives in the effects of grazing on riparian habitats
- The influence of differences in riparian habitat conservation areas (RHCAs) and riparian management areas (RMAs)
- The influence of restoration actions on riparian, stream channel, and aquatic habitat conditions
- The extent of detrimental soil conditions resulting from expected levels of timber harvest
- Changes in overall watershed conditions, considering all of the above factors

**Key indicator:** Vegetation condition

The percent area and average departure of each potential vegetation group within the Umatilla National Forest are displayed in table 164. Dry forest occurs within 43 percent of the Umatilla National Forest and is the most departed from the historical range of variability (HRV) of the three forested vegetation classes based on comparison to the historical range of stand density, age class structure, and species composition.

**Table 164. Percent of national forest and average departure score by potential vegetation group for the Umatilla National Forest**

| Potential Vegetation Group | Percent of UMA | Average Departure Score |
|---|---|---|
| Dry forest | 43% | 60 |
| Moist forest | 31% | 23 |
| Cold forest | 8% | 13 |

From an analysis of vegetation data aggregated for all potential vegetation groups for the Umatilla National Forest, 36 of 129 subwatersheds have vegetation that is slightly departed from HRV, 29 subwatersheds have vegetation that is moderately departed from HRV, and vegetation in 64 subwatersheds is highly departed from HRV. The expected future change in vegetation condition, based on the modeled change in departure scores of the three dominant forest potential vegetation groups and is expressed as the change in departure scores at years 10 and 20. All of the values in table 165 represent the degree of change toward HRV, or improved vegetation condition. Alternative D, for example, would result in a 4 percent decrease in the departure of forested vegetation for the national forest at year 10, and a 7.9 percent decrease in departure of forested vegetation at year 20. Based on the analysis of forested vegetation, alternative D would result in the greatest improvement in vegetation condition and alternative C the least.

Adjusting the departure scores of forested vegetation in each subwatershed on the Umatilla National Forest by the values in table 165 results in an improvement in vegetation conditions at 10 years and 20 years as displayed in table 166 and table 167. The tables display the number of subwatersheds in each of three condition classes, by alternative, compared to the existing condition. The change, or improvement, in vegetation departure is applied to all watersheds, and represents the average condition, even though it is likely that actual vegetation conditions will vary throughout the national forest.

**Table 165. Percent change in average forested vegetation departure score for each alternative for the Umatilla National Forest**

| Timeframe | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| At year 10 | 1.9% | 2.2% | 1.6% | 4.0% | 3.5% | 2.7% |
| At year 20 | 3.9% | 4.3% | 3.2% | 7.9% | 7.1% | 5.5% |

**Table 166. Forested vegetation condition classes and number of subwatersheds in each class at year 10 for each alternative for the Umatilla National Forest**

| Forested Vegetation Condition Class | Existing Condition | Alt. A Yr. 10 | Alt. B Yr. 10 | Alt. C Yr. 10 | Alt. D Yr. 10 | Alt. E Yr. 10 | Alt. F Yr. 10 |
|---|---|---|---|---|---|---|---|
| 1 | 36 | 43 | 43 | 40 | 52 | 49 | 43 |
| 2 | 29 | 31 | 31 | 34 | 26 | 29 | 31 |
| 3 | 64 | 55 | 55 | 55 | 51 | 51 | 55 |

**Table 167. Forested vegetation condition classes and number of subwatersheds in each class at year 20 for each alternative for the Umatilla National Forest**

| Forested Vegetation Condition Class | Existing Condition | Alt. A Yr. 20 | Alt. B Yr. 20 | Alt. C Yr. 20 | Alt. D Yr. 20 | Alt. E Yr. 20 | Alt. F Yr. 20 |
|---|---|---|---|---|---|---|---|
| 1 | 36 | 52 | 52 | 49 | 63 | 60 | 56 |
| 2 | 29 | 26 | 29 | 25 | 22 | 24 | 28 |
| 3 | 64 | 51 | 48 | 55 | 44 | 45 | 45 |

At year 10 and year 20, alternative D would result in the greatest improvement in forested vegetation condition, and would result in the most watersheds with vegetation in the least departed state (condition class 1) and the fewest in the most departed state (condition class 3). Alternatives A, B, and C would result in the fewest watersheds in the least departed condition and the highest number (51, 48, and 55, respectively) in the most departed condition. Alternative E would result in the second highest number of watersheds with vegetation in the least departed condition. Alternative F would produce the next highest number of watersheds in the least departed condition class.

The condition of forested vegetation in priority watersheds, the watersheds in which restoration actions are expected to be focused, is displayed in table 168 and table 169. Because expected changes in vegetation condition during the first decade of the plan period are small, there would be only slight change in the number of priority watersheds with vegetation in condition class 1 and little change in the number of priority watersheds in condition class 3 across all of the action alternatives. In 20 years, vegetation conditions would continue to improve at a slow rate. In alternatives D, E and F the number of watersheds with forested vegetation in condition class 3 would be reduced from 10 and 11 to 7, but little change would occur in the condition classes for alternatives A, B. and C.

**Table 168. Forested vegetation condition classes and number of priority watersheds in each class at year 10 for each alternative for the Umatilla National Forest**

| Forested Vegetation Condition Class | Existing Condition | Alt. A Yr. 10 | Alt. B Yr. 10 | Alt. C Yr. 10 | Alt. D Yr. 10 | Alt. E Yr. 10 | Alt. F Yr. 10 |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 4 | 4 | 3 | 4 | 4 | 4 |
| 2 | 2 | 0 | 0 | 1 | 1 | 1 | 0 |
| 3 | 11 | 11 | 11 | 11 | 10 | 10 | 11 |

**Table 169. Forested vegetation condition classes and number of priority watersheds in each class at year 20 for each alternative for the Umatilla National Forest**

| Forested Vegetation Condition Class | Existing Condition | Alt. A Yr. 20 | Alt. B Yr. 20 | Alt. C Yr. 20 | Alt. D Yr. 20 | Alt. E Yr. 20 | Alt. F Yr. 20 |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 4 | 4 | 4 | 4 | 4 | 4 |
| 2 | 2 | 1 | 2 | 0 | 4 | 4 | 4 |
| 3 | 11 | 10 | 9 | 11 | 7 | 7 | 7 |

**Key indicator:** Roads

Two measures of roads, total road density and hydrologically connected roads are used in this analysis. Within the 129 subwatersheds modeled on the Umatilla National Forest there are 5,240 miles of existing roads and an average road density of 2.4 miles per square mile. The 15 priority watersheds on the Umatilla National Forest contain 840 existing road miles and have an average road density of 2.2 miles per square mile. An estimated 1,690 miles of hydrologically connected roads occur throughout the national forest, of which 358 miles are in priority watersheds. In this analysis, road density is not assumed to change by alternative. Some road decommissioning or obliteration is expected to occur under each of the alternatives, but the miles of road to be decommissioned cannot be predicted at this time. The focus of this analysis is on the treatment of hydrologically connected roads in priority watersheds.

The objectives for road related restoration and the percentage of hydrologically connected roads in priority watersheds that this represents are displayed in table 170.

**Table 170. Roads treatment objectives (miles) and percent of hydrologically connected roads that would be treated in priority watersheds for the action alternatives for the Umatilla National Forest**

| Roads Treatment Objective (first decade) | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|
| Roads that would be treated (miles) | 260 | 450 | 800 | 300 | 270 |
| Percent of priority watersheds | 72.6% | 125.6% | 223.3% | 83.7% | 75.4% |

The emphasis of road-related treatment objectives, as stated in appendix A, is to reduce road-related sedimentation by reducing the hydrological connectivity of the national forest road system. Comparing the objective levels to the estimated 358 miles of hydrologically connected roads, all such roads in priority watersheds would be treated in alternatives C and D. An additional 90 miles of hydrologically connected roads could be treated in key watersheds in alternative C and 440 miles road miles could be treated in key watersheds in alternative D in addition to road treatments in priority watersheds.

Seventy-three percent of hydrologically connected roads would be treated in alternative B, 84 percent in alternative E and 75 percent in alternative F. The existing road system extends the channel network in priority watersheds by about 26 percent. Hydrologic extension of the channel network due to national forest roads within priority watersheds would be reduced to near zero for alternatives C and D and to less than 7 percent on average for alternatives B, E, and F. Because the existing miles of hydrologically connected roads is low, the hydrologic influence of the road system in all priority watersheds would be substantially reduced for all alternatives, resulting in improved conditions in all priority watersheds as displayed in table 171 and table 172.

**Table 171. Hydrologically connected roads condition classes and number of priority watersheds in each class for the action alternatives for the Umatilla National Forest**

| Hydrologically Connected Roads Condition Class | Existing Condition | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| 1 | 8 | 15 | 15 | 15 | 15 | 15 |
| 2 | 3 | 0 | 0 | 0 | 0 | 0 |
| 3 | 4 | 0 | 0 | 0 | 0 | 0 |

**Table 172. Total roads condition classes and number of priority watersheds in each class for the action alternatives for the Umatilla National Forest**

| Total Roads Condition Class* | Existing Condition | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| 1 | 8 | 15 | 15 | 15 | 15 | 15 |
| 2 | 3 | 0 | 0 | 0 | 0 | 0 |
| 3 | 4 | 0 | 0 | 0 | 0 | 0 |

* The total roads condition class is based on both road density and hydrologically connected roads.

Because expected road treatment miles are high relative to the estimated miles of hydrologically connected roads, the expected improvement in condition, considering roads alone, would place all priority watersheds in condition class 1. The projected treatment miles in alternatives C and D are higher than the estimate of miles of hydrologically connected roads. It is expected that road treatments would be applied to other key watersheds resulting in more watersheds in improved condition in these two alternatives.

**Key Indicator:** Livestock grazing

Seventy-nine percent of the Umatilla National Forest is presently considered suitable for grazing by domestic cattle or sheep. Active allotments currently occur on 60 percent of the national forest area. Acres suitable for domestic livestock would be slightly lower in alternatives B, D, E, and F compared to alternative A. Suitable acres would be lower in alternative C by nearly 60 percent and higher under alternative D by 4 percent, relative to alternative A. Existing AUMs for cattle and sheep combined are currently 37,800 (alternative A) and would be 35,600 in alternative B, and 35,800 in alternatives D, E, and F. Only 4,200 AUMs would occur in alternative C, primarily due to the restriction of grazing from watersheds that contain Endangered Species Act-listed fish species.

The change in AUM levels is used to recalculate relative forage use intensity by alternative and assumed to change in all watersheds for the purpose of this analysis. The calculation of forage use in this analysis assumes that all areas of an allotment could be used by domestic livestock but forage production in areas known to be unsuitable is given a nominal value of 50 pounds per acre per year so that most of the use is accounted for by the acres that are suitable for domestic livestock. The resulting average use intensity across all 129 subwatersheds and in priority watersheds only is displayed in table 173. Under existing conditions, no subwatersheds have apparent use intensity higher than 40 percent, the level below which available forage species would be assumed to be protected (Holechek et al. 2006). Average use levels are expected to be slightly lower than alternative A in alternatives B, D, E, and F. Average forage use intensity would be near 1 percent for alternative C and the greatest calculated forage use intensity in any single subwatersheds would be near 2 percent.

**Table 173. Average percent forage use intensity in all watersheds and in priority watersheds for each alternative for the Umatilla National Forest**

| Watershed | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| All watersheds | 6.9% | 6.5% | 0.8% | 6.3% | 6.3% | 6.3% |
| Priority watersheds | 11.4% | 10.7% | 1.3% | 10.4% | 10.4% | 10.4% |

Based on livestock use alone, the number of watersheds in the Umatilla National Forest by condition class is displayed in table 174. The number of priority watersheds in each condition class is displayed in table 175.

**Table 174. Rangeland condition classes (based on upland forage use intensity) and number of watersheds in each class for each alternative for the Umatilla National Forest**

| Rangeland Condition Class | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| 1 | 103 | 107 | 129 | 94 | 107 | 107 |
| 2 | 23 | 21 | 0 | 28 | 21 | 21 |
| 3 | 3 | 1 | 0 | 7 | 1 | 1 |

**Table 175. Rangeland condition classes (based on upland forage use intensity) and number of priority watersheds in each class for each alternative for the Umatilla National Forest**

| Rangeland Condition Class | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| 1 | 8 | 8 | 15 | 7 | 8 | 8 |
| 2 | 6 | 7 | 0 | 4 | 7 | 7 |
| 3 | 1 | 0 | 0 | 4 | 0 | 0 |

The number of subwatersheds with the lowest relative use intensity (rangeland condition class 1) would be nearly equal in alternatives A, B, D, E, and F. This is true for all watersheds within the national forest, as well as for priority watersheds. For alternative C, all watersheds, including all priority watersheds would be expected to be in the highest condition class.

Livestock use of riparian areas is generally believed to be higher than use of uplands, unless specific measures (herding, off-channel water sources, fencing, etc.) are implemented (Clary and Webster 1990, Fleischner 1994, Bengeyfield 2006). Livestock forage use in riparian areas was estimated for the existing condition, but not for each alternative in this analysis. Instead, a comparison is made of allowable forage utilization in riparian areas (see table 154).

Differences in livestock use between alternatives would also be reflected in changes in forage use intensity in riparian areas. The largest relative reduction in livestock use of riparian areas would occur under alternative C due to reductions in stocking levels. Livestock forage use in all other alternatives would be similar to the existing condition except that use intensity would potentially be slightly higher in alternative D than in alternatives B, E, and F.

In alternatives B and D, utilization of woody riparian species and herbaceous vegetation would be limited to 40 percent of annual growth. The same limits would apply in alternatives E and F, with the exception that utilization limits would be lower in watersheds inhabited by bull trout, and alternative F would have slightly lower utilization limits in watersheds inhabited by anadromous fish, than would occur in alternative E. The stricter guidelines for alternatives E and F would apply in 35 subwatersheds containing bull trout (550,000 acres or 39 percent of national forest area) and 61 subwatersheds inhabited by anadromous salmon or steelhead (711,000 acres or 51 percent of national forest area).

**Key indicator:** Riparian habitat conservation area (RHCA) and riparian management area (RMA) acres

Present management of riparian areas under PACFISH (USDA and USDI 1995) and INFISH (USDA Forest Service 1995) includes the designation of riparian habitat conservation areas (RHCAs). RHCAs are portions or zones of watersheds where riparian-dependent resources receive primary emphasis. The zones have varying widths: 300 feet on either side of fish-bearing streams and permanently flowing non-fish-bearing streams; 150 feet from ponds, lakes, reservoirs and wetlands larger than one acre; and 100 feet if listed fish are present from seasonally flowing streams, wetlands smaller than one acre, landslides, and landslide-prone areas (50 feet if listed fish are not present).

Riparian management areas (RMAs) for alternatives B, E, and F would use the same basic definitions as RHCAs to define extent. RMAs are designated as management areas where specific desired conditions, standards, and guidelines apply. Riparian goals in PACFISH and INFISH are rearticulated as desired conditions for the action alternatives. RMA widths and extent are similar to RHCAs except that a width of 100 feet would apply to all seasonally flowing streams and small wetlands, whether or not the streams are fish-bearing. The management of RMAs and RHCAs would be similar in that work within RMAs would have to show progress towards desired conditions, and any management activity conducted within RMAs would have to be designed specifically for the benefit of aquatic and riparian-dependent resources, whereas management of RHCAs currently requires that attainment of riparian management objectives (RMOs) not be retarded (USDA Forest Service 1995).

The acres of RHCAs (alternative A) and RMAs (all action alternatives) and the minimum percent of national forest area that each would encompass are displayed in table 176.

**Table 176. Riparian management area (RMA) acres and percent of Umatilla National Forest for each alternative (RHCAs for alternative A)**

| Alt. A RHCAs acres (%) | Alt. B RMAs acres (%) | Alt. C RMAs acres (%) | Alt. D RMAs acres (%) | Alts. E and F RMAs acres (%) |
|---|---|---|---|---|
| 237,515(17%) | 237,530 (17%) | 499,781 (36%) | 106,880 (8%) | 237,530 (17%) |

RMA acres would be greatest for alternative C, which would have 300-foot wide buffers for all streams, regardless of class. Alternative D would have the least acres within RMAs because RMA widths would be the narrowest for streams in all classes. RMA widths in alternative D are based on Oregon Forest Practices guidelines, which do not require RMAs for the smallest non-fish-bearing streams with average annual flow of less than 2 cubic feet per second. A review by the Independent Multidisciplinary Science Team (IMST 1999) of the RMAs required by the Oregon

Forest Practices Act found that RMAs required by the act were insufficient to protect aquatic habitats because they were not applied to all streams, and specifically not to non-fish-bearing streams. However, alternative D, as currently designed would still apply RMAs to intermittent and seasonally flowing streams and therefore exceeds the requirements of the Oregon Forest Practices Act.

A discussion of reviews of the effectiveness of riparian buffers is included with discussion of RMAs for the Malheur National Forest and will not be repeated here. Based on these reviews, the RMAs in alternatives B, E, and F should be protective of most riparian functions. It is expected that RMAs will be delineated during project planning and will identify areas of potentially unstable ground for inclusion within RMAs. The RMAs in alternative C would likely be the most protective of unstable areas, as described by Tang and Montgomery (1995). The RMAs defined for alternative D would be the least protective, and may not be as efficient as the RMAs in all other alternatives at preventing sediment delivery to streams or providing for inputs of large organic debris, but may still provide most other functions desired of RMAs.

**Key indicator:** Number of wetland sites improved

Wetlands in National Forest System lands occur in a variety of settings, not all of which are associated with streams or rivers. Based on maps provided for the National Wetland Inventory (NWI) compiled by the U.S. Fish and Wildlife Service, off-channel and isolated wetlands comprise 20 percent or more in area of all wetlands on the Umatilla National Forest. According to NWI maps, there are potentially more than 1,200 small wetlands on the Umatilla National Forest, although the accuracy of the maps is not yet determined. These wetlands are an important component of the hydrology of watersheds within the national forest but are disproportionately important, relative to their size, as habitat for a variety of plant and animal species, and in some cases include species that occur only in specific wetland types. An objective for improvements to or restoration of a small number of these sites each year is included in each alternative. Potential actions include vegetative restoration, hydrologic restoration, and protection by fencing. The objectives levels for restoration of off-channel and isolated wetlands during the first decade of the plan period are displayed in table 177.

**Table 177. Objective for wetland site restoration for the action alternatives for the Umatilla National Forest**

| Wetland Site Restoration Objective (first decade) | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|
| Number of sites | 25 | 35 | 35 | 40 | 35 |

**Key Indicator:** Riparian and stream channel restoration

Priority watershed on the Umatilla National Forest include an estimated 240 miles of perennial streams, based on an average of 16.3 perennial stream miles in each of 15 subwatersheds. The objectives for riparian restoration range from 150 to 300 miles during the first decade of the plan period, compared to approximately 240 perennial stream miles in priority watersheds within the national forest (see table 178).

**Table 178. Objective for riparian area improvement (miles) and percent of priority watershed miles that would be improved for the action alternatives for the Umatilla National Forest**

| Riparian Area Improvement Objective (first decade) | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|
| Riparian area improvement in miles | 150 | 300 | 150 | 225 | 210 |
| Percent of riparian miles that would be improved (priority watersheds) | 63% | 125% | 63% | 94% | 88% |

The objective levels in alternative C are higher than the sum of perennial stream miles in priority watersheds by 60 miles. It is assumed that additional riparian habitat would be treated in key watersheds, so some improvement in riparian conditions would occur outside of priority watersheds. Sixty-three to 94 percent of riparian miles would be improved in alternatives A, C, E and F. It is likely that not all riparian habitats are in need of active restoration, so that the objective levels stated for each action alternative may exceed the need in priority watersheds and that improvements could be made through active restoration of riparian conditions outside of priority watersheds.

The objective levels for stream miles improved potentially include activities such as reconnection of floodplain connections, stabilizing stream banks, restoring channel morphology, and addition of large wood in streams. Because channel reconstruction is costly to design and implement, the number of miles completed in any year varies and is usually small. However, there are a variety of actions or methods that could be used place to improve stream channel and aquatic habitat conditions in lieu of channel reconstruction. The objective miles expected to be completed during the first decade of the plan period and the percentage of perennial stream miles in priority watersheds that those objectives represent are displayed in table 179.

**Table 179. Objective for stream channel restoration (miles) and percent that would be improved for the action alternatives for the Umatilla National Forest**

| Stream Channel Restoration Objective (first decade) | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|
| Stream channel restoration (miles) | 30 | 55 | 30 | 45 | 40 |
| Percent of stream miles that would be improved | 13% | 23% | 13% | 19% | 17% |

It is likely that stream channel restoration will occur through a variety of actions in addition to physical channel reconstruction. Other potential actions include placement of large wood, reconnection of side channels, conversion of water rights to restore or protect instream flows, and reintroduction of beaver to suitable sites. Replacement or removal of culverts that block access to potential habitat is also expected to occur. Redesign of road-stream crossings is also likely to contribute to improved channel and habitat conditions, both upstream and downstream of these sites. The miles displayed in table 179 are much lower than total stream miles in priority watersheds, but it is likely only a small percentage of stream channels are in actual need of this kind of restoration. Improvements to stream channel conditions will also occur in response to expected improvements in upland and riparian conditions, but may take some time to be realized. Active channel restoration is expected to occur in 13 to 19 percent of stream miles in priority watersheds, if needed, and depending in the alternative selected. The fewest stream miles would be restored under alternatives B and D, and the most in alternatives C and E.

**Key indicator:** Watershed condition class: number of watersheds in improved condition

The combined effect of vegetation condition, roads, and livestock use intensity are the factors used to represent upslope condition in watersheds. The number of watersheds in each condition class for alternative A at 10 years is used as the baseline condition as forested vegetation conditions are expected to improve regardless of the alternative selected. Improvements to upland conditions will eventually contribute to improved conditions in riparian and aquatic habitats by moderating watershed hydrology, reducing the rate of watershed runoff, and reducing sediment delivery to streams.

The influence of riparian, stream channel and aquatic habitat restoration is not represented in the following tables but is expected to contribute substantially to overall watershed conditions. The influence of these actions on watershed conditions as displayed in the following tables will be described separately.

**Table 180. Watershed condition classes and subwatersheds in each class along with subwatersheds improved at year 10 for each alternative for the Umatilla National Forest**

| Watershed Condition Class | Alt. A Yr. 10 | Alt. B Yr. 10 | Alt. C Yr. 10 | Alt. D Yr. 10 | Alt. E Yr. 10 | Alt. F Yr. 10 |
|---|---|---|---|---|---|---|
| 1 | 32 | 68 | 83 | 78 | 70 | 69 |
| 2 | 62 | 46 | 36 | 39 | 45 | 45 |
| 3 | 35 | 15 | 10 | 12 | 14 | 15 |
| Subwatersheds improved | NA | 20 | 25 | 23 | 21 | 20 |

**Table 181. Watershed condition classes and subwatersheds in each class along with subwatersheds improved at year 20 for each alternative for the Umatilla National Forest**

| Watershed Condition Class | Alt. A Yr. 20 | Alt. B Yr. 20 | Alt. C Yr. 20 | Alt. D Yr. 20 | Alt. E Yr. 20 | Alt. F Yr. 20 |
|---|---|---|---|---|---|---|
| 1 | 38 | 76 | 88 | 90 | 80 | 78 |
| 2 | 66 | 41 | 31 | 29 | 37 | 39 |
| 3 | 25 | 12 | 10 | 10 | 12 | 12 |
| Subwatersheds improved | NA | 23 | 25 | 25 | 23 | 23 |

**Table 182. Watershed condition classes and priority watersheds in each class along with priority watersheds improved at year 10 for each alternative for the Umatilla National Forest**

| Watershed Condition Class | Alt. A Yr. 10 | Alt. B Yr. 10 | Alt. C Yr. 10 | Alt. D Yr. 10 | Alt. E Yr. 10 | Alt. F Yr. 10 |
|---|---|---|---|---|---|---|
| 1 | 1 | 12 | 15 | 12 | 14 | 13 |
| 2 | 7 | 3 | 0 | 3 | 1 | 2 |
| 3 | 7 | 0 | 0 | 0 | 0 | 0 |
| Priority watersheds improved | NA | 7 | 7 | 7 | 7 | 7 |

**Table 183. Watershed condition classes and priority watersheds in each class along with priority watersheds improved at year 20 for each alternative for the Umatilla National Forest**

| Watershed Condition Class | Alt. A Yr. 20 | Alt. B Yr. 20 | Alt. C Yr. 20 | Alt. D Yr. 20 | Alt. E Yr. 20 | Alt. F Yr. 20 |
|---|---|---|---|---|---|---|
| 1 | 1 | 13 | 15 | 14 | 14 | 13 |
| 2 | 7 | 2 | 0 | 1 | 1 | 2 |
| 3 | 7 | 0 | 0 | 0 | 0 | 0 |
| Priority watersheds improved | NA | 7 | 7 | 7 | 7 | 7 |

The largest change in the number of watersheds in improved condition class and the largest number of watersheds in condition class 1 would occur in alternative C in response to the higher percentage of improvements to the national forest road system in key and priority watersheds and the large reduction in livestock use. The rate of change in the condition of forested vegetation is relatively moderate, but would still result in the addition of 5 to 12 subwatersheds to condition class 1 between years 10 and 20 depending on the alternative. At year 20, the number of watersheds in each condition class would be similar in alternatives C (88) and D (90), and upslope conditions in nearly 70 percent of all subwatersheds would be in condition class 1. About 60 percent of subwatersheds would have upslope conditions in condition class 1 in alternatives B, E, and F.

No priority subwatersheds would have upslope conditions in class 3 at 10 years. Most of this change would result from improvements to the road system in these watersheds. Reductions in livestock grazing in alternative C and increases in alternative D are the main factor that would place more subwatersheds in condition class 1 in alternative C at 10 years (15) compared to alternative D (12). By year 20 there would be little difference between the alternatives in upslope conditions within priority subwatersheds.

Improvements in upslope watershed condition would be moderated by the fact that the area of detrimental soil disturbance during the first decade of the plan period is expected to be greater by nearly 7,000 acres in alternative D than in alternative C because of the levels and types of harvest that are expected to occur (see table 184). Detrimental soil conditions due to future vegetation management actions would be lowest under alternatives A (7,090 acres), F (7,690 acres), and B (7,740 acres) and highest in alternatives D (17,910 acres), E (13,480 acres), and C (11,200). Detrimental soil conditions influence hydrologic conditions in watersheds by soil compaction and loss of ground cover and an increase potential for surface soil erosion. Sites of detrimental soil disturbance represent an increased risk of sediment delivery to streams, if the sites occur near streams or to hydrologically connected roads. Objective levels for improving soil hydrologic function in areas disturbed by management activities would be lower than the acres of new disturbance in all alternatives. Unless additional actions were taken to protect or improve soil conditions, alternatives B, C, D, E, and F would results in increase in the area of detrimental soil conditions of approximately 2,700, 2,200, 13,400, 6,000, and 690 acres, respectively during the first decade of the plan period. The smallest difference in acres disturbed and acres improved would occur in alternative F, and the largest in alternative D.

**Table 184. Acres of detrimental soil conditions and acres improved (treated) at year 10 for each alternative for the Umatilla National Forest**

| Soil Condition | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| Area disturbed | 8,530 | 7,490 | 5,030 | 22,700 | 15,230 | 10,720 |
| Area improved (treated) | NA | 4,500 | 8,000 | 4,000 | 6,000 | 5,400 |

The consideration of detrimental soil conditions, combined with expected riparian and aquatic habitat restoration supports the conclusion that alternative C would likely result in the greatest improvement in watershed conditions. The influence of detrimental soil conditions in alternative D would result in lower overall watershed conditions than is displayed in table 180 and table 181, but the distribution of watersheds by condition class would still be similar to alternatives B, E, and F.

Difference in grazing use intensity based on differences in allowed AUMs would result in the greatest reductions in livestock use intensity in alternative C. Grazing effects in all other alternatives would be similar to the existing condition, with the exception that grazing effects in alternative D would be higher than at present. The same relative differences in grazing use intensity would occur in upland as well as riparian habitats. Alternatives E and F would have livestock stocking levels as the existing condition but would implement stricter riparian utilization guidelines that are expected to result in greater improvement in the conditions of riparian habitats, including riparian shrubs.

Active restoration of riparian habitats would improve the condition of a higher percentage of riparian habitats under alternative C than in any of the other alternatives. Less improvement would occur in alternatives B and D.

Monitoring data collected for the PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program (PIBO) appears to show that riparian and aquatic habitat conditions in National Forest System lands in the Blue Mountains has improved since implementation of the aquatic conservation strategies within PACFISH and INFISH. Since the inception of monitoring in 2001, and based on repeat sampling of the sites through 2010, 8 of 13 habitat indicators and 9 of 11 vegetation indicators appear to be showing favorable, or upward, trends in condition. This trend in condition is expected to continue under all alternatives, but would likely be strongest in alternative C, and weakest in alternative D.

### *Wallowa-Whitman National Forest*

Effects of the alternatives are described on the following order:

- Upslope conditions within watersheds are described in terms of expected changes in the condition of forested vegetation, hydrological connectivity of the road system, and grazing use intensity
- Differences between alternatives in the effects of grazing on riparian habitats
- The influence of differences in riparian habitat conservation areas and riparian management areas
- The influence of restoration actions on riparian, stream channel, and aquatic habitat conditions
- The extent of detrimental soil conditions resulting from expected levels of timber harvest

Changes in overall watershed conditions, considering all of the above factors

**Key indicator:** Vegetation condition

The percent area and average departure of each potential vegetation group on the Wallowa-Whitman National Forest are displayed in table 185. Dry forest occurs within 34 percent of the Wallowa-Whitman National Forest and is the most departed from the historical range of variability (HRV) for the three forested vegetation classes. The combined area of dry forest, cold forest, and moist forest comprises 70 percent of upland vegetation.

**Table 185. Percent of national forest and average departure score by potential vegetation group for the Wallowa-Whitman National Forest**

| Potential Vegetation Group | Percent of WAW | Average Departure Score |
|---|---|---|
| Dry forest | 34% | 56 |
| Moist forest | 18% | 23 |
| Cold forest | 18% | 37 |

From an analysis of vegetation data aggregated for all potential vegetation groups for the Wallowa-Whitman National Forest, 108 of 223 subwatersheds have vegetation that is slightly departed from HRV, 40 subwatersheds have vegetation that is moderately departed from HRV, and vegetation in 75 subwatersheds is highly departed from the HRV. The expected future change in vegetation condition is based on the modeled change in departure scores of the three dominant forest potential vegetation groups, expressed as the change in departure values at 10 years and 20 years from the existing condition. All of the values displayed by alternative in table 186 represent the degree of change towards HRV, or improved vegetation class. Alternative D, for example would result in a 1.8 percent decrease in the departure of forested vegetation for the national forest at year 10, and a 3.5 percent decrease in departure of forested vegetation at year 20. Based on the analysis of forested vegetation, alternative D would result in the greatest improvement in vegetation condition and alternative C the least, although the percent improvement in vegetation conditions in all alternatives is expected to be relatively modest.

**Table 186. Percent change in average forested vegetation departure score for each alternative for the Wallowa-Whitman National Forest**

| Timeframe | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| At year 10 | 1.1% | 1.1% | 0.8% | 1.8% | 1.5% | 1.2% |
| At year 20 | 2.3% | 2.3% | 1.7% | 3.5% | 3.0% | 2.4% |

Adjusting the departure scores of forested vegetation in each subwatershed on the Wallowa-Whitman National Forest by the values in table 186 results in an improvement in vegetation conditions at 10 years and 20 years as displayed in table 187 and table 188. The tables display the number of subwatersheds in each of three condition classes, by alternative, compared to the existing condition. The change, or improvement, in vegetation departure is applied to all watersheds, and represents the average condition, even though it is likely that actual vegetation conditions will vary throughout the national forest.

**Table 187. Forested vegetation condition classes and number of subwatersheds in each class at year 10 for each alternative for the Wallowa-Whitman National Forest**

| Forested Vegetation Condition Class | Existing Condition | Alt. A Yr. 10 | Alt. B Yr. 10 | Alt. C Yr. 10 | Alt. D Yr. 10 | Alt. E Yr. 10 | Alt. F Yr. 10 |
|---|---|---|---|---|---|---|---|
| 1 | 108 | 114 | 114 | 114 | 114 | 114 | 114 |
| 2 | 40 | 42 | 42 | 42 | 47 | 47 | 47 |
| 3 | 75 | 67 | 67 | 67 | 62 | 62 | 62 |

**Table 188. Forested vegetation condition classes and number of subwatersheds in each class at year 20 for each alternative for the Wallowa-Whitman National Forest**

| Forested Vegetation Condition Class | Existing Condition | Alt. A Yr. 20 | Alt. B Yr. 20 | Alt. C Yr. 20 | Alt. D Yr. 20 | Alt. E Yr. 20 | Alt. F Yr. 20 |
|---|---|---|---|---|---|---|---|
| 1 | 108 | 116 | 116 | 114 | 121 | 121 | 116 |
| 2 | 40 | 48 | 48 | 47 | 49 | 43 | 48 |
| 3 | 75 | 59 | 59 | 62 | 53 | 59 | 59 |

At year 10, more watersheds would have vegetation in the least departed condition (condition class 1), but there would be little difference in condition between alternatives. At 20 years, more watersheds would have vegetation in condition class 1 with alternatives D and E (121). Alternative C would have the fewest watersheds in condition class 1 and the most in the most departed state (condition class 3), but difference in vegetation conditions at 20 years between alternatives would remain relatively small due to the relatively slow rate of improvement in vegetation conditions within the national forest.

The condition of forested vegetation in priority watersheds, the watersheds in which restoration actions are expected to be focused, is displayed in table 189 and table 190. Improvements in vegetation conditions at 10 years and 20 years are slight, or no change in the distribution of watersheds by condition class would occur between year 10 and year 20 because the existing condition of vegetation in most priority watersheds is only slightly departed from the historic range. At both year 10 and year 20, 22 of 27 priority watersheds would have vegetation in condition class 1 and only 1 in condition class 3.

**Table 189. Forested vegetation condition classes and number of priority watersheds in each class at year 10 for each alternative for the Wallowa-Whitman National Forest**

| Forested Vegetation Condition Class | Existing Condition | Alt. A Yr. 10 | Alt. B Yr. 10 | Alt. C Yr. 10 | Alt. D Yr. 10 | Alt. E Yr. 10 | Alt. F Yr. 10 |
|---|---|---|---|---|---|---|---|
| 1 | 21 | 22 | 22 | 22 | 22 | 22 | 22 |
| 2 | 5 | 4 | 4 | 4 | 4 | 4 | 4 |
| 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

**Table 190. Forested vegetation condition classes and number of priority watersheds in each class at year 20 for each alternative for the Wallowa-Whitman National Forest**

| Forested Vegetation Condition Class | Existing Condition | Alt. A Yr. 20 | Alt. B Yr. 20 | Alt. C Yr. 20 | Alt. D Yr. 20 | Alt. E Yr. 20 | Alt. F Yr. 20 |
|---|---|---|---|---|---|---|---|
| 1 | 21 | 22 | 22 | 22 | 22 | 22 | 22 |
| 2 | 5 | 4 | 4 | 4 | 4 | 4 | 4 |
| 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

**Key indicator:** Roads

Two measures of roads, total road density and hydrologically connected roads are used in this analysis. Within the 223 subwatersheds modeled on the Wallowa-Whitman National Forest there are 10,600 miles of existing roads and an average road density of 3.2 miles per square mile. The 27 priority watersheds on the Wallowa-Whitman National Forest contain 2,141 existing road miles and have an average road density of 3.2 miles per square mile. An estimated 4,226 miles of hydrologically connected roads occur within the national forest, of which 829 miles are in priority watersheds. In this analysis, road density is assumed not to change by alternative. Some road decommissioning or obliteration is expected to occur under each of the alternatives, but the miles of road to be decommissioned cannot be predicted at this time. The focus of this analysis is on the treatment of hydrologically connected roads in priority watersheds.

The objectives for road related restoration and the percentage of hydrologically connected roads in priority watersheds that this represents are displayed in table 191.

**Table 191. Roads treatment objectives (miles) and percent of hydrologically connected roads that would be treated in priority watersheds for the action alternatives for the Wallowa-Whitman National Forest**

| Roads Treatment Objective (first decade) | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|
| Roads that would be treated (miles) | 260 | 450 | 800 | 300 | 270 |
| Percent of priority watersheds | 72.6% | 125.6% | 223.3% | 83.7% | 75.4% |

The emphasis of road-related treatment objectives, as stated in appendix A, is to reduce road-related sedimentation by reducing the hydrological connectivity of the national forest road system. Comparing the objective levels to the estimated 830 miles of hydrologically connected roads, approximately 97 percent would be treated under alternative D, and 48 percent under alternative C, 36 percent would be treated under alternative E, 32 percent in alternative F and 31 percent in alternative A.

The existing road system extends the channel network in priority watersheds by an average 43 percent. Hydrologic extension of the channel network due to national forest roads would be reduced to near zero in alternative D, to 36 percent in alternatives B and F, to 28 percent in alternative C, and to 34 percent in alternative E. The hydrologic connectivity of the road system would be substantially reduced under all alternatives, with the largest changes expected in alternatives D (95 percent) and 64 to 72 percent in all other alternatives). The influence of national forest roads on watershed condition would be similar between alternatives B, E, and F after objectives are met. The influence of the national forest road system on watershed conditions would be negligible in all 27 priority watersheds in alternative D and 18 of 27 priority watersheds in alternative C. The hydrologic influence of the road system would be small in 9, 11, and 10 subwatersheds, respectively for alternatives B, E, and F (see table 192).

**Table 192. Hydrologically connected roads condition classes and number of priority watersheds in each class for the action alternatives for the Wallowa-Whitman National Forest**

| Hydrologically Connected Roads Condition Class | Existing Condition | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| 1 | 3 | 9 | 18 | 27 | 11 | 10 |
| 2 | 8 | 10 | 4 | 0 | 9 | 10 |
| 3 | 16 | 8 | 5 | 0 | 7 | 7 |

Because existing road density in priority watersheds would remain relatively high and is assumed to change very little in this analysis, the road system is still expected to have some effect on watershed conditions as displayed in the distribution of watersheds by condition class in table 193. The largest improvement in condition class would still occur in alternative D, and the next highest in alternative C. Alternatives B, E, and F would still result in improvements in road-related conditions compared to existing conditions.

**Table 193. Total roads condition classes and number of priority watersheds in each class for the action alternatives for the Wallowa-Whitman National Forest**

| Total Roads Condition Class* | Existing Condition | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| 1 | 1 | 3 | 3 | 5 | 3 | 3 |
| 2 | 6 | 7 | 13 | 22 | 8 | 8 |
| 3 | 20 | 17 | 11 | 0 | 16 | 16 |

* The total roads condition class is based on both road density and hydrologically connected roads.

**Key Indicator:** Livestock grazing

Twenty-eight percent of the Wallowa-Whitman National Forest is presently considered suitable for grazing by cattle or sheep. Active allotments currently occur on 55 percent of the national forest. Approximately 433,000 acres of the national forest would be considered suitable for livestock grazing for alternatives A, B, E and F. A total of 447,000 acres would be considered suitable for alternative D (38 percent of the national forest) and 157,000 acres for alternative C (9 percent of the national forest).

Allowable AUMs for cattle and sheep combined are currently 81,500 (alternative A) and would be 77,500 in alternative B; 29,500 with alternative C; 84,500 in alternative D; and 80,500 in alternatives E and F. AUMs would be 74 percent lower in alternative C and 4 percent higher in alternative D than in the other alternatives. The change in AUM levels is used to recalculate relative forage use intensity by alternative and assumed to change in all watersheds for the purpose of this analysis. Average use intensity would be 25 percent in alternative D across all grazed watersheds, but would be 17 percent in priority watersheds. Average use intensity in priority watersheds would be 12 percent in alternatives A, B, E and F and 3 percent in alternative C.

The calculation of forage use in this analysis assumes that all areas of an allotment could be used by domestic livestock but forage production in areas known to be unsuitable is given a nominal value of 50 pounds per acre per year so that most of the use is accounted for by the acres that are suitable for domestic livestock. The resulting average use intensity across all 223 subwatersheds and in priority watersheds only is displayed in table 194. Under existing conditions, 31 of 223 subwatersheds have apparent use intensity higher than 40 percent. Average use levels are expected to be similar in alternatives A, D, E, and F (17 percent), and slightly lower in alternative B (16 percent). Average forage use intensity would be 6 percent in alternative C and two watersheds would potentially have use intensities higher than 40 percent.

**Table 194. Average percent forage use intensity in all watersheds and in priority watersheds for each alternative for the Wallowa-Whitman National Forest**

| Watershed | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| All watersheds | 17.0% | 16.2% | 6.2% | 17.6% | 17.0% | 17.0% |
| Priority watersheds | 12.0% | 11.4% | 4.3% | 12.4% | 12.0% | 12.0% |

Based on livestock use alone, the numbers of watershed on the Wallowa-Whitman National Forest by condition class are displayed in table 195. The number of priority watersheds in each condition class is displayed in table 196.

**Table 195. Rangeland condition classes (based on upland forage use intensity) and number of watersheds in each class for each alternative for the Wallowa-Whitman National Forest**

| Rangeland Condition Class | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| 1 | 131 | 131 | 209 | 119 | 131 | 131 |
| 2 | 40 | 40 | 10 | 33 | 40 | 40 |
| 3 | 52 | 52 | 4 | 71 | 52 | 52 |

**Table 196. Rangeland condition classes (based on upland forage use intensity) and number of priority watersheds in each class for each alternative for the Wallowa-Whitman National Forest**

| Rangeland Condition Class | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| 1 | 14 | 14 | 27 | 14 | 14 | 14 |
| 2 | 11 | 11 | 0 | 6 | 11 | 11 |
| 3 | 2 | 2 | 0 | 7 | 2 | 2 |

The number of subwatersheds with the lowest relative use intensity would be nearly equal in alternatives A, B, E and F (131 of 223). This is true for all watersheds within the national forest as well as for priority watersheds. In alternative C, all priority watersheds and nearly all other watersheds would be expected to be in the highest condition class.

Livestock use of riparian areas is generally believed to be higher than in uplands unless specific measures (herding, off-channel water sources, fencing, etc.) are implemented (Clary and Webster 1990, Fleischner 1994, Bengeyfield 2006). Livestock forage use in riparian areas was estimated for the existing condition but not for each alternative in this analysis. Instead, a comparison is made of allowable forage utilization in riparian areas (see table 154).

Differences in livestock use between alternatives would also be reflected in changes in forage use intensity in riparian areas. The largest relative reduction in livestock use of riparian areas would occur under alternative C due to reductions in stocking levels. Livestock forage use in all other alternatives would be similar to the existing condition except that use intensity would potentially be slightly higher in alternative D than in alternatives B, E, and F.

In alternatives B and D, utilization of woody riparian species and herbaceous vegetation would be limited to 40 percent of annual growth. The same limits would apply in alternatives E and F, with the exception that utilization limits would be lower in watersheds inhabited by bull trout, and alternative F would have slightly lower utilization limits in watersheds inhabited by anadromous fish. The stricter guidelines in alternatives E and F would apply in 53 subwatersheds containing bull trout (640,000 acres, 36 percent of forest area) and 88 subwatersheds inhabited by anadromous salmon or steelhead (905,000 acres, 50 percent of forest area).

**Key indicator:** Riparian habitat conservation area (RHCA) and riparian management area (RMA) acres

Present management of riparian areas under PACFISH (USDA and USDI 1995) and INFISH (USDA Forest Service 1995) includes the designation of riparian habitat conservation areas (RHCAs). RHCAs are portions or zones of watersheds where riparian-dependent resources receive primary emphasis. The zones have varying widths: 300 feet on either side of fish-bearing streams and permanently flowing non-fish-bearing streams; 150 feet from ponds, lakes, reservoirs and wetlands larger than one acre; and 100 feet if listed fish are present from seasonally flowing streams, wetlands smaller than one acre, landslides, and landslide-prone areas (50 feet if listed fish are not present).

Riparian management areas (RMAs) for alternatives B, E, and F would use the same basic definitions as RHCAs to define extent. RMAs are designated as management areas where specific desired conditions, standards, and guidelines apply. Riparian goals in PACFISH and INFISH are rearticulated as desired conditions for the action alternatives. RMA widths and extent are similar to RHCAs except that a width of 100 feet would apply to all seasonally flowing streams and small wetlands, whether or not the streams are fish bearing. The management of RMAs and RHCAs would be similar in that work within RMAs would have to show progress towards desired conditions, and any management activity conducted within RMAs would have to be designed specifically for the benefit of aquatic and riparian-dependent resources, whereas management of RHCAs currently requires that attainment of riparian management objectives not be retarded (USDA Forest Service 1995).

The acres of RHCAs (alternative A) and RMAs (all action alternatives) and the minimum percent of forest area that each would encompass are displayed in table 197.

**Table 197. Acres and percent of national forest area in RMAs for each alternative (RHCAs for alternative A) for the Wallowa-Whitman National Forest**

| Alt. A RHCAs acres (%) | Alt. B RMAs acres (%) | Alt. C RMAs acres (%) | Alt. D RMAs acres (%) | Alts. E and F RMAs acres (%) |
|---|---|---|---|---|
| 360,123 (20%) | 362,520 (20%) | 727,527 (40%) | 162,932 (9%) | 360,123 (20%) |

RMA acres would be greatest for alternative C, which would have 300-foot wide buffers for all streams, regardless of class. Alternative D would have the least acres within RMAs because RMA widths would be the narrowest for streams in all classes. RMA widths in alternative D are based on Oregon Forest Practices guidelines, which do not require RMAs for the smallest non-fish-bearing streams with average annual flow of less than 2 cubic feet per second. A review by the Independent Multidisciplinary Science Team (IMST 1999) of the RMAs required by the Oregon Forest Practices Act found that RMAs required by the act were insufficient to protect aquatic habitats because they were not applied to all streams, and specifically not to non-fish-bearing streams. However, alternative D, as currently designed would still apply RMAs to intermittent and seasonally flowing streams and therefore exceeds the requirements of the Oregon Forest Practices Act.

A discussion of reviews of the effectiveness of riparian buffers is included with discussion of RMAs for the Malheur National Forest and will not be repeated here. Based on these reviews, the RMAs in alternatives B, E, and F should be protective of most riparian functions. It is expected that RMAs will be delineated during project planning and will identify areas of potentially unstable ground for inclusion within RMAs. The RMAs in alternative C would likely be the most protective of unstable areas, as described by Tang and Montgomery (1995). The RMAs defined for alternative D would be the least protective, and may not be as efficient as the RMAs in all other alternatives at preventing sediment delivery to streams or providing for inputs of large organic debris, but may still provide most other functions desired of RMAs.

**Key indicator:** Number of wetland sites improved

Wetlands in National Forest System lands occur in a variety of settings, not all of which are associated with streams or rivers. Based on maps provided for the National Wetland Inventory compiled by the U.S. Fish and Wildlife Service, off-channel and isolated wetlands comprise 40 percent or more in area of all wetlands on the Wallowa-Whitman National Forest. According to National Wetland Inventory maps, there are potentially 3,000 small wetlands on the Wallowa-Whitman National Forest, although the accuracy of the maps is not yet determined. These wetlands are an important component of the hydrology of watersheds on the forest but are disproportionately important, relative to their size, as habitat for a variety of plant and animal species, and in some cases include species that occur only in specific wetland types. An objective for improvements to or restoration of a small number of these sites each year is included in each alternative. Potential actions include vegetative restoration, hydrologic restoration, and protection by fencing. The objectives levels for restoration of off-channel and isolated wetlands during the first decade of the plan period are displayed in table 198.

**Table 198. Objective for wetland site restoration for the action alternatives for the Wallowa-Whitman National Forest**

| Wetland Site Restoration Objective (first decade) | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|
| Number of sites | 25 | 35 | 35 | 40 | 35 |

**Key Indicator:** Riparian and stream channel restoration

Priority watershed on the Wallowa-Whitman National Forest include an estimated 440 miles of perennial streams, based on an average of 16.3 perennial stream miles in each of 26 subwatersheds. The objectives for riparian restoration range from 250 to 500 miles during the first decade of the plan period, compared to approximately 440 perennial stream miles in priority watersheds within the national forest (see table 199).

**Table 199. Objective for riparian area improvement (miles) and percent of priority watershed miles that would be improved for the action alternatives for the Wallowa-Whitman National Forest**

| Riparian Area Improvement Objective (first decade) | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|
| Riparian area improvement in miles | 250 | 500 | 250 | 375 | 350 |
| Percent of riparian miles that would be improved (priority watersheds) | 57% | 114% | 57% | 85% | 80% |

The objective levels in alternatives C are higher than the sum of perennial stream miles in priority watersheds by 60 miles. It is assumed that an equivalent number of miles of riparian habitats would be treated in other key watersheds, so some improvement in riparian conditions would occur outside of priority watersheds. It is also likely that not all riparian habitats are in need of active restoration, so that the objective levels stated may exceed the need in priority watersheds and that more restoration work could be accomplished outside of priority watersheds.

The objective levels for stream miles improved potentially include activities such as reconnection of floodplain connections, stabilizing stream banks, restoring channel morphology, and addition of large wood in streams. Because channel reconstruction is costly to design and implement, the number of miles completed in any year varies and is usually small. However, there are a variety of actions or methods that could be used place to improve stream channel and aquatic habitat conditions in lieu of channel reconstruction. The objective miles expected to be completed during the first decade of the plan period and the percentage of perennial stream miles in priority watersheds that those objectives represent are displayed in table 200.

**Table 200. Objective for stream channel restoration (miles) and percent that would be improved for the action alternatives for the Wallowa-Whitman National Forest**

| Stream Channel Restoration Objective (first decade) | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|
| Stream channel restoration (miles) | 40 | 60 | 40 | 60 | 50 |
| Percent of stream miles that would be improved | 9% | 14% | 9% | 14% | 11% |

It is likely that stream channel restoration will occur through a variety of actions in addition to physical channel reconstruction. Other potential actions include placement of large wood, reconnection of side channels, conversion of water rights to restore or protect instream flows, and reintroduction of beaver to suitable sites. Replacement or removal of culverts that block access to potential habitat is also expected to occur. Re-design of road-stream crossings is also likely to contribute to improved channel and habitat conditions, both upstream and downstream of these sites. The miles displayed in table 200 are much lower than total stream miles in priority watersheds, but is likely that only a small percentage of stream channels are in actual need of this kind of restoration. Improvements to stream channel conditions will also occur in response to expected improvements in upland and riparian conditions, but may take some time to be realized. Active channel restoration is expected to occur in 9 to 14 percent of stream miles in priority watersheds, depending in the alternative selected. The fewest stream miles would be restored under alternatives B and D, and the most in alternatives C and E.

**Key indicator:** Watershed condition class: number of watersheds in improved condition

The combined effect of vegetation condition, roads, and livestock use intensity are the factors used to represent upslope condition in watersheds. For this part of the analysis only, the number of watersheds in each condition class in alternative A at 10 years is used as the baseline condition as forested vegetation conditions are expected to improve regardless of the alternative selected. Improvements to upland conditions will eventually contribute to improved conditions in riparian and aquatic habitats by moderating watershed hydrology, reducing the rate of watershed runoff, and reducing sediment delivery to streams.

The influence of riparian, stream channel and aquatic habitat restoration is not represented in the following tables but is expected to contribute substantially to overall watershed conditions. The influence of these actions on watershed conditions as displayed in the following tables will be described separately.

**Table 201. Watershed condition classes and subwatersheds in each class along with subwatersheds improved at year 10 for each alternative for the Wallowa-Whitman National Forest**

| Watershed Condition Class | Alt. A Yr. 10 | Alt. B Yr. 10 | Alt. C Yr. 10 | Alt. D Yr. 10 | Alt. E Yr. 10 | Alt. F Yr. 10 |
|---|---|---|---|---|---|---|
| 1 | 80 | 78 | 87 | 86 | 78 | 78 |
| 2 | 83 | 89 | 90 | 79 | 90 | 89 |
| 3 | 60 | 56 | 46 | 58 | 55 | 56 |
| Subwatersheds improved | NA | 4 | 14 | 2 | 5 | 4 |

**Table 202. Watershed condition classes and subwatersheds in each class along with subwatersheds improved at year 20 for each alternative for the Wallowa-Whitman National Forest**

| Watershed Condition Class | Alt. A Yr. 20 | Alt. B Yr. 20 | Alt. C Yr. 20 | Alt. D Yr. 20 | Alt. E Yr. 20 | Alt. F Yr. 20 |
|---|---|---|---|---|---|---|
| 1 | 82 | 80 | 87 | 88 | 80 | 80 |
| 2 | 85 | 89 | 90 | 80 | 91 | 90 |
| 3 | 56 | 54 | 46 | 55 | 52 | 53 |
| Subwatersheds improved | NA | 6 | 14 | 5 | 8 | 7 |

For watersheds across the forest (table 201) the largest change in the number of watersheds in improved condition class occurs in alternatives C (87) and D (86). The relatively large reduction in grazing intensity in alternative C is offset by the larger reduction in hydrologically connected roads in alternative D and there would be little difference in change in forested vegetation conditions by year 10.

Continued improvements in forested vegetation conditions would result in modest changes in the distribution of watershed conditions by year 20 with small increases in the number of watersheds in condition class 1 in alternatives between year 10 and year 20. The changes are small because the improvement in vegetation would be only 1 to 2 percent in 10 years for any alternative. Alternative C would result in the most watersheds in improved condition, but alternative D would result in more watersheds (88 versus 87) in condition class 1 than would alternative C.

In priority watersheds, alternative D would have the highest number of watersheds in condition class 1 (14) at year 10 and result in the most watersheds in improved condition (8). The distribution of priority watersheds by condition class would be nearly the same in all other alternatives, with 4 to 6 subwatersheds in condition class 1 and 18 to 19 in condition class 2.

**Table 203. Watershed condition classes and priority watersheds in each class along with priority watersheds improved at year 10 for each alternative for the Wallowa-Whitman National Forest**

| Watershed Condition Class | Alt. A Yr. 10 | Alt. B Yr. 10 | Alt. C Yr. 10 | Alt. D Yr. 10 | Alt. E Yr. 10 | Alt. F Yr. 10 |
|---|---|---|---|---|---|---|
| 1 | 4 | 5 | 6 | 14 | 5 | 5 |
| 2 | 15 | 18 | 19 | 13 | 19 | 18 |
| 3 | 8 | 4 | 2 | 0 | 3 | 4 |
| Priority watersheds improved | NA | 4 | 6 | 8 | 5 | 4 |

**Table 204. Watershed condition classes and priority watersheds in each class along with priority watersheds improved at year 20 for each alternative for the Wallowa-Whitman National Forest**

| Watershed Condition Class | Alt. A Yr. 20 | Alt. B Yr. 20 | Alt. C Yr. 20 | Alt. D Yr. 20 | Alt. E Yr. 20 | Alt. F Yr. 20 |
|---|---|---|---|---|---|---|
| 1 | 4 | 5 | 6 | 14 | 5 | 5 |
| 2 | 17 | 18 | 19 | 13 | 19 | 19 |
| 3 | 6 | 4 | 2 | 0 | 3 | 3 |
| Priority watersheds improved | NA | 4 | 6 | 8 | 5 | 5 |

These results need to be tempered by the fact that the area of detrimental soil disturbance during the first decade of the plan period is expected to be greater by 16,000 acres in alternative D than in alternative C because of the levels and types of harvest that are expected to occur (see table 205). Detrimental soil conditions due to future vegetation management actions would be lowest under alternatives C (3,730 acres) and B (7,530 acres), and highest in alternatives D (19,480 acres) and E (12,680 acres). Detrimental soil conditions influence hydrologic conditions in watersheds by soil compaction and loss of ground cover and an increase potential for surface soil erosion. Sites of detrimental soil disturbance represent an increased risk of sediment delivery to streams, if the sites occur near streams or hydrologically connected roads. Objective levels for improving soil hydrologic function in areas disturbed by management activities would be lower than the acres of new disturbance in all alternatives except C. Unless additional actions were taken to protect or improve soil conditions, alternatives B, D, E, and F would results in increase in the area of detrimental soil conditions of approximately 1,000, 14,000, 3,000, and 600 acres, respectively during the first decade of the plan period.

**Table 205. Acres of detrimental soil conditions and acres improved (treated) at year 10 for each alternative for the Wallowa-Whitman National Forest**

| Soil Condition | Alt. A | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F |
|---|---|---|---|---|---|---|
| Area disturbed | 6,740 | 7,530 | 3,730 | 19,480 | 12,680 | 9,120 |
| Area improved (treated) | NA | 6,500 | 12,000 | 6,000 | 9,500 | 8,500 |

The inclusion of detrimental soil conditions, combined with expected riparian and aquatic habitat restoration supports the conclusion that alternative C would likely result in the greatest improvement in watershed conditions and that the least overall improvement in watershed conditions would likely occur under alternative D. Alternatives C, E, and F would all improve a higher percentage of riparian miles than would alternative D and result in more improvement in aquatic and riparian habitats than either alternative D or B.

Difference in grazing use intensity based on differences in allowed AUMs would result in the greatest reductions in livestock use intensity in alternative C. Grazing effects in all other alternatives would be similar to the existing condition, with the exception that grazing effects in alternative D would be higher than at present. The same relative differences in grazing use intensity would occur in upland as well as riparian habitats. Alternatives E and F would have livestock stocking levels as the existing condition but would implement stricter riparian utilization guidelines that are expected to result in greater improvement in the conditions of riparian habitats, including riparian shrubs.

Monitoring data collected for the PACFISH/INFISH Biological Opinion Effectiveness Monitoring Program (PIBO) appears to show that riparian and aquatic habitat conditions in National Forest System lands in the Blue Mountains has improved since implementation of the aquatic conservation strategies within PACFISH and INFISH. Since the inception of monitoring in 2001, and based on repeat sampling of the sites through 2010, 8 of 13 habitat indicators and 9 of 11 vegetation indicators appear to be showing favorable, or upward, trends in condition. This trend in condition is expected to continue under all alternatives, but would likely be strongest in alternative C, and weakest in alternative D.

## Cumulative Effects

### *Watershed Condition*

For the purpose of assessing cumulative watershed effects, the spatial boundary is the extent of the 25 sub-basins listed in table 131. The temporal boundary is the 10 to 20 year period over which the selected alternative would be implemented.

This analysis has used the results of a model (EMDS, Reynolds 2006; Gecy 2013a) that considers the combined effects of changes in forest vegetation condition, changes in road density and connectivity to channel networks, and differences in grazing practices to assess differences in overall watershed (hillslope) conditions between alternatives. Model output is combined with an assessment of watershed, soil, riparian, and stream channel restoration to assess the overall outcomes of implementing each alternative for each forest at 10 years and 20 years. It is assumed in this analysis that all proposed restoration work, as stated in the objectives, will be implemented in 10 years and that all restoration will be focused in priority watersheds. Further, when that work is completed, it is expected that a new set of priority watersheds will be identified by the forests and needed restoration work will continue.

The modeled values used in this analysis account for 50 percent of overall watershed condition scores. Riparian condition, and stream channel/aquatic habitat conditions for the remaining 50 percent and were only modeled for the existing condition.

In this analysis, road density and hydrologically connected roads account for 60 percent of the model scores presented in this analysis, with road density and miles of hydrologically connected roads weighted equally. Road density is not assumed to change in the model because in recent years few road miles have been officially decommissioned by the three forests. The model results show, and study results (Nelson et al. 2011) support, that treating hydrologically connected roads has a positive effect on watershed condition. Road decommissioning would have a similar positive result on watershed condition with two main differences: (1) existing studies appear to consistently show that a high percentage of road-related sediment is produced by a relatively small percentage of the road network, making it likely that, mile for mile, road decommissioning will not have as much influence on improving watershed conditions as would focusing on the roads that have the greatest effect; and, (2) road decommissioning, however it is accomplished, is more expensive, per mile, than treating hydrologically connected roads, with cost differences that may be higher by a factor of 10 or more, making it likely that an emphasis on road decommissioning would result in a slower rate of improvement, or less improvement in condition over time. However, both road decommissioning and the treatment of hydrologically connected roads will result in improved watershed condition, watershed function, and water quality resulting from reduced sediment delivery to streams, although there may be benefits to other resources from reducing the size of the forest road network that are not part of this analysis.

Forested vegetation condition, expressed as the percent departure from the historical range of variability, accounts for 27 percent of the model scores used in this analysis. Fire regime condition class departure scores for forested vegetation were calculated using methods described in Barrett et al. 2010) and imported into EMDS. The departure score partially substitutes for an assessment of past land use, fire, insect and disease, and other disturbances because they influence the fire regime condition class results. Vegetation condition is expected to improve in all alternatives, but at varying rates. Improvement in forested vegetation conditions would also contribute to improved riparian conditions resulting in more riparian shade, increased channel stability from higher inputs of large wood, and other effects, although some changes may occur over longer time spans than the expected 10-20 year duration of the proposed plan. A potential mechanism of improved riparian conditions in areas of highly-departed dry forest is moving these stands from existing overstocked, dense stands of younger trees towards open stands of old trees. Liquori and Jackson (2001) have shown that areas that historically had open stands of Ponderosa pine along streams often had willow species in the understory, and that stream reaches with willows had much lower width-depth ratios (narrower channels) than streams lined with dense stands of young Ponderosa pine.

Grazing use intensity accounts for 13 percent of the model scores presented in this analysis and is defined by Holechek et al. (2006) as the percentage of the long-term average forage production that is used by livestock. This analysis is based on an average forage production and it the year-to-year variability of forage production is not known. Holechek et al. (2006) suggest that grazing impacts to forage species may be positive if forage use is less than 40 percent of average production, but recognize that the research in support of this view is limited. This analysis assumes, based on available research, that grazing impacts to riparian vegetation are likely to be higher than to upland vegetation, because riparian sites are preferred by cattle (e.g. Gillen et al. 1984), but that grazing impacts to riparian areas also depend on how individual allotments are managed. The results of this analysis show that alternatives with lower grazing use intensity (alternative C) would have more of a positive effect on watershed and riparian conditions than alternatives with higher grazing use intensity (alternatives B, D, E, F).

Watershed restoration is expected to be focused in 69 selected priority watersheds in National Forest System lands over the next 10 years. The rationale for focusing watershed restoration in a smaller set of watersheds is that restoration work is expected to be more effective at achieving desired conditions if work is focused on smaller areas at one time, rather than spread across whole forests. In addition, 157 watersheds are named as key watersheds, which represent areas with good existing aquatic and riparian habitat conditions and expected to act as anchors of existing good habitat conditions for anadromous and resident fish species. Emphasis in key watersheds is in maintaining or improving existing conditions. Priority watersheds, key watersheds, desired conditions, and standards and guidelines that address the protection and management of watersheds, riparian areas, and aquatic habitats are part of a region-wide strategy and are expected to be incorporated into the land management plans of all national forests in the Pacific Northwest region as these forests revise their land management plans.

The U.S. Bureau of Land Management (BLM) manages more than 2 million acres of lands in the analysis area. Livestock grazing is the dominant land use of these lands, but BLM lands are also managed for multiple uses including wildlife habitat, recreation, development of energy and mineral resources, and other uses. Within watershed occupied by bull trout and anadromous fish, BLM has management direction for riparian areas that is similar to management direction in National Forest System lands.

A number of other federal, state, tribal, and private agencies or organizations are actively engaged in stream and watershed restoration, or provide funding for watershed-related work, some of which occurs in National Forest System lands, with the rest occurring primarily on private lands downstream of National Forest System lands. These entities include the Bureau of Land Management, the Bonneville Power Administration, Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, the Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Warm Springs Indian Reservation, watershed councils, and other local and national organizations. In addition, Federal funding available to the forests is often leveraged with funding from other sources to conduct watershed-related restoration. Watershed councils exist for nearly every subbasin in the Blue Mountains and have defined restoration needs at the sub-basin scale needed to restore aquatic and riparian habitat conditions. The Nez Perce Tribe, Confederated Tribes of the Umatilla Indian Reservation, and Confederated Tribes of the Warm Springs Indian reservation are active partners with the three national forests and conduct habitat-related restoration in the Middle Fork John Day River, Umatilla River, Grande Ronde River, Imnaha River and other locations in the Blue Mountains. The three Native American tribes have active restoration programs in the Blue Mountains that contribute to improved watershed, riparian and aquatic habitat conditions in or adjacent to National Forest System lands.

Watershed-related restoration work by other entities complements work performed by the Forest Service and contributes to improved watershed, riparian, and aquatic habitat conditions. Most of this work is expected to occur in lands or along rivers downstream of National Forest System lands. It is expected that this work will continue regardless of the alternative selected, but alternatives with higher emphasis on watershed restoration of National Forest System lands are more likely to attract partnership funding by entities outside of the Forest Service.

### *Water Quality and Water Uses*

Streams within National Forest System lands in the Blue Mountains that do not meet state water quality criteria are generally listed on state 303d lists due to high stream temperatures or high suspended sediment loads, or both. Within National Forest System lands, it is assumed that improvements in overall watershed condition will contribute to improved water quality of streams within individual forests, and that improvement in forested vegetation condition and decrease of the influence of forest roads will contribute to improved water quality.

Both Oregon Department of Environmental Quality and Washington Department of Ecology base their analyses of Total Maximum Daily Loads (TMDL) on the maintenance of stream shade provided by riparian vegetation. Both agencies acknowledge a number of other factors that contribute to increased stream temperatures, but recognize that improvements to or increases in riparian conditions and stream shade are more likely to result in improvements to water quality.

Downstream of the forests, livestock grazing is the dominant land use on BLM lands, and livestock grazing and irrigated agriculture are the dominant uses of most private lands within the analysis area. Water withdrawals affect stream temperature by reducing the volume of flow and increasing the effect of solar radiation on stream temperature. Water withdrawals affect stream temperature indirectly by decreasing the integrity of riparian vegetation and decreasing bank stability. Based on data for the 1995 water year, water withdrawals from all basins totaled 2.7 million acre-feet, or 38 percent of total runoff (Solley et al. 1998). Consumptive use was 1.3 million acre-feet, or 18 percent of total runoff. Because more than 90 percent of water in the Blue Mountains is used for irrigation, most water is diverted during the growing season with diversion beginning on March 15 or April 1 and ending September 30 or October 15, depending on the basin and state water right duty schedules. Water withdrawals have the greatest effect on water volume at the same time, July and August, when air temperatures and solar radiation are highest. On average, consumptive water use during the growing season is nearly 60 percent of total streamflow from all rivers and exceeds 90 percent in some river basins with the largest areas in irrigated agriculture.

The influence of National Forest System management on downstream water quality varies by river basin, the extent of downstream water use, the season of use, and the volume of flow relative to the flow of receiving waters. Rivers that begin in National Forest System lands in the Blue Mountains drain to the Snake River, Columbia River, or to the Closed Basins of eastern Oregon. The total flow of all rivers that begin in National Forest System lands is about 5.5 percent of the flow of the Columbia River at the Dalles, Oregon. The effect of individual rivers on downstream water quality also varies because they enter the Snake or Columbia rivers at different points; effects are further moderated by management of dams for hydroelectric power and flood control is a dominant effect on flow and sediment regimes of the larger rivers.

The extent of cumulative effects for individual rivers, discussed in upstream to downstream order, is further modified as follows:

- Silver Creek and Silvies River flow into the Harney-Malheur Lakes closed basins. During the summer growing season, much of the flow of both rivers is used for irrigation before entering either lake, though the effect is stronger Silver Creek above Harney Lake. Effects to water quantity and quantity do not extend beyond Malheur Lake because it has no outlet.
- Tributaries of the North Fork Malheur River flow to Warm Springs Reservoir and tributaries of the North Fork Malheur flow to Beulah Reservoir before entering the Snake River. Both reservoirs are used to store water for irrigation. The reservoirs strongly modify any potential water quality (sediment, nutrient, thermal) or quantity effect of upstream waters on the Snake River because the reservoir traps inflowing sediment and the dam regulates downstream flow.
- The North and South Forks of Burnt River flow to Unity Reservoir and the stored water is used for irrigation on private lands along the lower Burnt River. The Burnt River flows through geologic formations containing mercury. Limestone is quarried near Durkee, Oregon for use in cement manufacturing and mercury-laden residue enters the river. The lower 45 miles of Burnt River are not listed as water quality limited due to the presence of mercury by Oregon DEQ, but are of special concern.
- Stream flow in the upper Powder River is stored in Phillips Reservoir and is used for irrigation in Baker Valley. Tributaries to the Powder River that begin in the Elkhorn Mountains flow to the Powder River above Thief Valley Reservoir, which also stores water for irrigation along the lower Powder River. Burnt River, Powder River, and Eagle Creek enter the Snake River above Brownlee Dam. Pine Creek enters the Snake River below

Oxbow Dam. Burnt River contributes mercury to Oxbow reservoir, but there are other sources of mercury to the Snake River, so the effect of water from the Burnt River on water quality is not completely known. Burnt River, Powder River, Eagle Creek, and Pine Creek may have localized effects on water quality at and downstream of the points where they enter the Snake River, but have little effect on water quantity downstream of the Hell's Canyon complex of dams due to the effect that those dams have on downstream flow regulation.

- The upper Wallowa River flows to Wallowa Lake and water is diverted for irrigation at several points along the river, beginning immediately below the outlet of Wallowa Lake. The Imnaha River, all other tributaries of the Grande Ronde River, and Asotin Creek enter the Snake River above Lower Granite Dam. Sediment effects are limited to the pool behind Lower Granite Dam. Thermal water quality effects are limited by the entry to the same reach of the Salmon, Little Salmon, and Clearwater Rivers from the Idaho side of the Snake River. The Lower Granite pool acts as a heat sink that further limits the water temperature effect of the Grande Ronde and Imnaha Rivers, which otherwise provide water that is cooler than the Snake River.
- The Tucannon River enters the Snake River above Lower Monumental Dam. The flow of the Tucannon is small relative to the Snake River, so its effects on both water quantity and quality are limited.
- The Walla Walla and Umatilla Rivers enter the Columbia River downstream of the confluence of the Columbia and Snake Rivers and above McNary dam. Water in both basins is heavily used for irrigation. However, due to a recent water rights exchange, some of the water used for irrigation in the Umatilla basin now comes directly from the Columbia River in order to preserve instream flows for anadromous fish in the Umatilla River.
- Willow Creek and the John Day River enter the Columbia River above the John Day dam. The drainage area and streamflow of Willow Creek are both small. A dam above Heppner, Oregon regulates the flow and most water is used for irrigation lower in the basin. Outflow to the Columbia River is very small and Willow Creek has a negligible effect on either water quantity or quality in the Columbia River. Water from the John Day River is diverted for irrigation use during the growing season. Water temperatures in the lower river exceed 80 degree Fahrenheit in summer months, based on data available from the U.S. Geological Survey. During high flows, a plume of suspended sediment enters the Columbia River from the John Day River that is mostly derived from highly erodible sedimentary and volcaniclastic rocks in the area surrounding the John Day Fossil Beds National Monument. The plume is confined to the south bank of the Columbia River and may extend for a few miles downstream during the highest flow events, but does not extend below the John Day dam.
- Water flowing in the Snake and Columbia Rivers is regulated for hydropower generation and flood control. The reservoirs, or pools, behind each dam act as thermal sinks that have a substantial effect on water temperature and stream ecology. Water in the rivers that emanate from the national forests in the Blue Mountains is generally of high quality, though reaches in each river are listed as water quality limited for stream temperature and some are also listed for sediment. For most of the year, stream temperatures of these rivers are likely cooler than the Columbia or Snake Rivers at the points where they enter. The John Day, Umatilla, Walla Walla, and Malheur rivers all experience high summer water temperatures in their lower reaches that limit, at least seasonally, their ability to provide habitat for cold water fish. Water temperatures are highest when air temperatures are high and streamflow is lowest. Water diverted from these rivers for irrigation exacerbates any existing effect on water temperature

because smaller water volumes warm more quickly. Irrigation return flows also influence water temperature, because the water is warmed after being diverted and before it reenters a given river.

- The influence of the national forests on water temperature depends strongly on stream shade provided by riparian vegetation as well as maintaining channel morphology, which maintains floodplain connections where they exist and contributes to exchange of cooler groundwater with surface streams. Impacts of actions within the national forests and past impacts that have resulted in loss or degraded riparian and aquatic habitats that contribute to elevated stream temperatures could be reversed through restoration actions that restore healthy riparian and aquatic habitats.
- The potential effects of the rivers emanating from the Blue Mountains on high flows is negligible because the flow of the individual rivers is small compared to the rivers they enter, and because flow in the Snake and Columbia Rivers is strongly regulated by dams used for flood control and electric power generation.
- Floods have occurred within individual river basins and will occur again. Maintaining healthy vegetative cover, adequate ground cover, and minimizing the hydrologic connectivity of the forest road system would all contribute to the moderation of high flows, but may not eliminate them.

### Effects of Climate Change

Climate change, because it results in changes in the hydrologic cycle due to changes in temperature and precipitation, including the form of precipitation, has the potential to fundamentally alter watershed processes and disturbance regimes over the next several decades. In particular, snowpacks in the Pacific Northwest are expected to be particularly sensitive to warming. April 1 snow water equivalent (SWE) has been declining for the past few decades across the western U.S. There has been an observed 35 percent decline in April 1 SWE in the Blue Mountains since 1970 that is comparable to changes observed elsewhere in the Pacific Northwest (Gecy 2013c). Runoff from snowmelt may occur earlier in the season, and the amount of runoff resulting from snowmelt is expected to decline in response to warming temperatures in coming decades. By the end of this century, late season runoff from snow may be restricted to higher elevations, if it occurs at all. Decreases in snowmelt runoff imply earlier runoff timing and lower summer streamflow for most, if not all streams. Further, climate change is expected to increase the frequency of rain-on-snow floods and winter flood peaks (versus spring snowmelt flood peaks), and increasing temperature is likely to increase drought risk because of reduced water storage for summer use and the long-term variability of dry years and wet years in the Pacific Northwest.

Winter stream flow is expected to become higher and more variable as temperatures increase. Increased stream water temperatures may increase the extent and duration of lethal or sub-lethal stream temperatures for cold-water fish species in lowland rivers, particularly bull trout, but also to cold-water fish species in general.

Changes in temperature and the timing and magnitude of rainfall will influence the distribution and composition of forest and nonforested vegetation. Increased atmospheric carbon dioxide may reduce vegetation water demand, but the magnitude of the effect has been a subject of scientific debate. Over time, increased temperature is expected to result in substantially higher vegetative water requirements due to increased evapotranspiration, and the predicted small increases in precipitation in the region are unlikely to be large enough to compensate for the effect of increases in temperature. As a consequence of increased vegetative growth, water demand by vegetation is likely to increase and there could also be increased risk of drought mortality, increased insect and disease risk, and greatly increased fire risk.

Cumulative effects on watershed, aquatic, and riparian dependent resources will depend, to a large degree, on the extent to which watershed restoration and vegetation management actions contribute to resilient landscapes. Under all alternatives, the desired conditions for watershed, aquatic, and riparian dependent resources are for the maintenance or restoration of the processes responsible for creating and maintaining healthy and productive watersheds. While some of these conditions may be more difficult to attain under climate change, achieving these conditions is most likely to result in landscapes resilient to expected climate changes, at least for the 10 to 20 year planning period.

National Forest System lands in the Blue Mountains encompass parts of 25 subbasins and 15 river systems. Most of these basins have multiple ownerships with differing management goals. In several river basins, the dominant land use is irrigated agriculture and water use is high relative to available streamflow. Actual streamflow is 10 percent or less of natural streamflow during the growing season in several basins with the highest irrigation water demand. Aquatic habitat connectivity is low, at least seasonally, in these areas. In addition, water supplies are fully appropriated in most, if not all, river basins in the Blue Mountains. The basins in which current water use is highest, relative to water supply, are likely to be the most at risk if expected climate changes are realized, because water demand will increase as temperature increases and water availability is likely to decrease.

### *Effects from the Alternatives*

None of the alternatives would alleviate potential climate change, but all alternatives include or allow for management actions that would improve the ability of national forest resources to adapt to a changing climate. The alternatives vary in the amount of these actions likely to occur. Alternative C places the highest emphasis on active restoration of riparian and aquatic habitats, but some restoration work would occur under all alternatives. Both alternatives C and D would result in the treatment of a high percentage of hydrologically-connected roads, but the increased roads use for alternative D would partially offset benefits from that alternative. Improvements would potentially be smaller for the Malheur National Forest because of existing high road densities in a large number of watersheds, but there would be some benefits in all alternatives. Benefits would be greatest under alternatives C and D. The effect of the Umatilla National Forest road system on sediment delivery and runoff rates could be substantially reduced for all alternatives. The reduction in the hydrologic effects of the Wallowa-Whitman National Forest road system would be reduced the most with alternative D; however, the potential benefits of road-related improvements for alternative D would be at least partially offset by increases in traffic and resulting road surface erosion.

Alternatives C, E, and F would have the highest rates of culvert replacement. Alternative C would make the greatest contribution to improving effective stream shade and aquatic habitat connectivity, partially offsetting rising temperatures. There is some potential that alternative D, through active vegetation management, would result in more resilient forested stands. Alternative C and, to a slightly lesser extent, alternative B would also promote resilience because they would have the most acres where natural disturbance regimes could operate.

All alternatives would foster ongoing community-based watershed restoration partnerships and contribute to an all-lands watershed improvement to some extent. Watersheds with active partnerships would likely continue in priority watersheds that have shared ownership. Alternative D would have the most variable and uncertain contribution from collaborative restoration partnerships based on greater emphasis on resource utilization. Alternatives A and B would be the same as current contributions. Alternatives C, E, and F, with greater levels of watershed protection and active restoration, would contribute more to overall watershed improvement through community-based watershed restoration.

See volume 2 for the remainder of chapter 3

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